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A New Species of *Dicranodontium* (Musci: Dicranaceae) from Panama

Bruce Allen
Missouri Botanical Garden, P.O. Box 299, St. Louis, Missouri 63166-0299, U.S.A.

ABSTRACT. The presence of an autoicous species in *Dicranodontium* (*Dicranodontium intermedium*, species nova) further supports Williams's taxonomic decision to unite *Atractylocarpus* and *Dicranodontium*.

Dicranodontium is a group of medium-sized mosses typically having narrow to setaceous leaves, broad costae, linear leaf cells, nonsheathing perichaetial leaves, and cygneous setae. The genus is gametophytically identical to *Atractylocarpus:* the genera differ only in sexuality (dioicous in *Dicranodontium*, autoicous in *Atractylocarpus*) and the stance of their moist setae (cygneous in *Dicranodontium*, erect to flexuous in *Atractylocarpus*). Based on his observations on the variability of setae curvature within identical species, Williams (1913) synonymized the two genera. The following new species of *Dicranodontium*, which has a cygneous seta but is autoicous, adds further support to William's taxonomic view of these two genera.

Dicranodontium intermedium Allen, sp. nov. TYPE: Panama. Chiriquí: Volcán Barú, 8°45′N, 82°30′W, *Allen 9123* (holotype, MO; isotypes, NY, PMA). Figures 1–7.

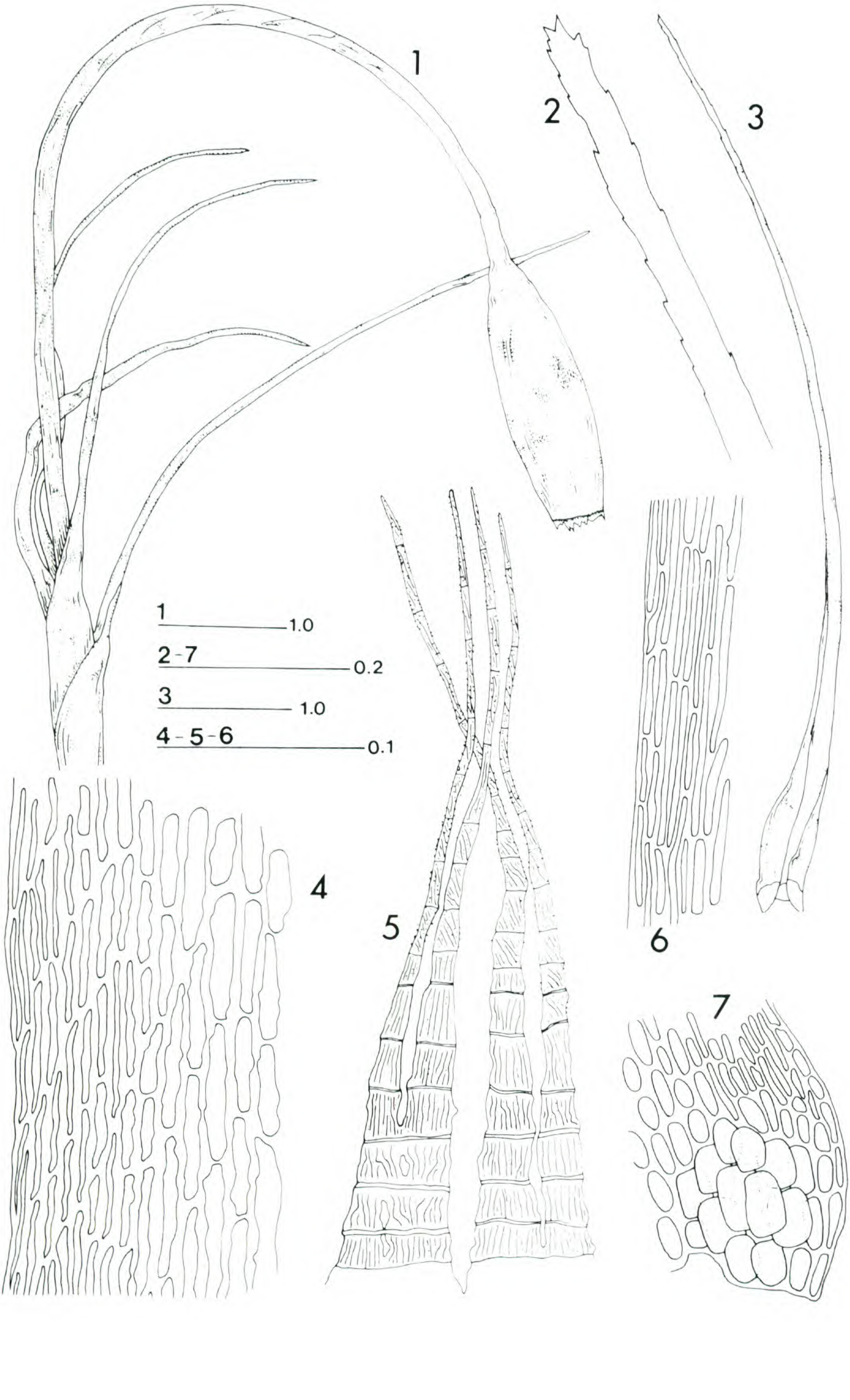
Species nova *D. meridionali* affinis, a qua differt facie grossiore, sexuali statu autoico et cellulis interioribus basalibus foliorum incrassatis, porosis.

Plants medium sized, in loose, erect, greenish yellow tufts, epiphytic or occasionally terrestrial. Stems moderately to densely white or red-tomentose, up to 5 cm long, branching irregularly; epidermal cells thick-walled, red-brown. Leaves evenly and well spaced, erect-spreading to falcate; concave below, tubulose above, narrowly lanceolate from a shortly ovate base, 8–11 mm long, apex long setaceous, sharply and densely denticulate above. Upper leaf cells linear, firm-walled; median leaf cells long-rectangular, incrassate and porose, occasionally smooth-walled; basal cells near the costa rectangular, incrassate and strongly porose, the outer basal cells longer and narrower forming a short, hyaline border; alar cells well developed, red-brown, occasionally fugacious. Autoicous. Perigonia terminal on short branches (1.5–5.0 mm) below the perichaetia. Setae yellow becoming red, smooth, 10–13 mm long, red, twisted and erect when dry, cygneous when wet. Capsules erect and symmetrical, smooth or weakly furrowed when dry, oblong, 2.0–2.5 mm long, lightly roughened at base; peristome yellowish becoming dark red; teeth 0.5 mm long, deeply divided (at times almost to the base), dorsal surface vertically striate. Opercula 1.5 mm long. Calyptrae 3.0 mm long, entire at base. Spores lightly papillose, yellow, 20 μm.

Paratypes. PANAMA. CHIRIQUÍ: Volcán Barú, *Allen 9127, 9132, Davidse & D'Arcy 10290I* (all MO).

Epiphytic on branches in subcanopy, on tree trunks, fallen logs and occasionally terrestrial between 2,300 and 3,505 m.

Dicranodontium intermedium has broad leaves that are atypical for the genus. In gross aspect it looks very much like a species of *Campylopus*. Furthermore, its well-developed alar cells and incrassate, porose basal leaf cells are common features of that genus. However, its linear upper leaf cells and autoicous sexual condition cannot be accommodated in *Campylopus*. Three species of *Dicranodontium* (sensu Williams, 1913) are now known from Central America. They are separated in the following key.


1
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2-7 0.2
3 1.0
4-5-6 0.1
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KEY TO THE SPECIES OF *DICRANODONTIUM* IN CENTRAL AMERICA

1a. Inner basal leaf cells enlarged, thin-walled, non-porose and strongly contrasting with narrow, incrassate and porose outer basal leaf cells; dioicous ..... *D. meridionale* Bartr.

1b. Inner basal cells not differentiated from the outer basal cells, either firm-walled or incrassate and porose throughout; autoicous.

2a. Leaves broadly ovate at base, basal and median leaf cells incrassate and porose, alar cells well developed; setae cygneous when wet ..... *D. intermedium* Allen

2b. Leaves linear to shortly ovate at base, basal and median cells firm-walled straight or weakly porose, alar cells poorly developed, fugacious; setae erect to flexuous when wet ..... *D. longiseta* (Hook) Williams

Acknowledgment. I thank Jan-Peter Frahm for his opinions and comments on this species.

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Figures 1–7. *Dicranodontium intermedium* Allen. —1. Sporophyte. —2. Leaf apex. —3. Leaf. —4. Lower leaf cells. —5. Peristome teeth, outer (dorsal) surface. —6. Upper leaf cells. —7. Alar cells. Scale bars in mm. Drawn from the holotype.

Draba barclayana (Brassicaceae), a New Species from Colombia

Ihsan A. Al-Shehbaz
Missouri Botanical Garden, P. O. Box 299, St. Louis, Missouri 63166-0299, U.S.A.

ABSTRACT. *Draba barclayana*, a new Colombian species endemic to the Cordillera Oriental, is described, and the characters distinguishing it from the nearest relative, the Ecuadorian endemic *D. spruceana*, are given.

Of the approximately 65–70 species of *Draba* indigenous to South America (Al-Shehbaz, 1991), at least 21 (16 endemic) grow in Colombia (author's compilation). Several of these have been described only recently (Al-Shehbaz, 1989; Rangel & Santana, 1989), whereas others belong to species complexes in need of critical study. The following species, named after Harriet G. Barclay, one of its collectors, belongs to a difficult group, which Schulz (1927) recognized as section *Adenodraba* O. E. Schulz. As indicated by Fernald (1934) and Al-Shehbaz (1987), however, Schulz's (1927, 1936) sectional classification of *Draba* is evidently artificial, and a thorough study of the entire genus is needed before meaningful infrageneric divisions are recognized.

Draba barclayana Al-Shehbaz, sp. nov. TYPE: Colombia. Boyacá: Cordillera Oriental, Sierra Nevada del Cocuy, Alto Ritacuva, wet areas with cushion plants (*Distichia*) surrounded by *Espeletia* slopes, SW facing, alt. 4,400 m, 16 Apr. 1959, *Barclay & Juajibioy 7398* (holotype, GH).

Herba perennis prostrata; folia basalia rosulata, oblonga vel oblanceolato-spathulata, 8–15 mm longa, 3–4.5 mm lata, glabra, ciliata, pilis simplicibus et furcatis; infructescentia subumbellata, ebracteata, usque ad 8 mm longa; pedicelli fructiferi divaricati, 4–6 mm longi; petala alba, obovata, 3.5–4.5 mm longa; antherae ovatae, subapiculatae, 0.6–0.7 mm longae; siliquae ovato-lanceolatae, 5–7 mm longae, 2–2.2 mm latae; semina ignota.

Prostrate perennials. Stems branched, to 7 cm long, the branches slender, terminating in clusters of subrosulate leaves, sparsely pubescent when young, soon glabrescent. Basal leaves oblong to oblanceolate-spatulate, 8–15 mm long, 3–4.5 mm wide, subsessile, base cuneate-attenuate, margin entire or obscurely 1-toothed on each side, ciliate with simple or long-stalked furcate trichomes to 1 mm long, apex obtuse to subacute; cauline leaves similar to basal ones, gradually reduced in size upward, when young minutely pubescent on both surfaces with simple or furcate trichomes to 0.1 mm long, soon glabrescent. Inflorescences ebracteate, corymbose racemes, hardly elongated in fruit; infructescences subumbellate, 3–8 mm long; fruiting pedicels divaricate, straight, minutely pubescent, 4–6 mm long. Sepals ovate, 2–2.5 mm long, ca. 1.5 mm wide, erect, nonsaccate, sparsely pubescent with simple and furcate trichomes to 0.1 mm long. Petals white, obovate, 3.5–4.5 mm long, ca. 2 mm wide, subtruncate, attenuate to a clawlike base. Filaments subequal, conspicuously dilated at base, ca. 2.5 mm long; anthers ovate, 0.6–0.7 mm long, subapiculate. Nectar glands ringlike, subtending the bases of all filaments. Fruits ovate-lanceolate, 5–7 mm long, 2–2.2 mm wide; style less than 1 mm; valves and seeds not seen.

Draba barclayana, which is so far known only from the type collection, is most closely related to the Ecuadorian endemic *D. spruceana* Weddell. It is readily distinguished by its ebracteate, subumbellate infructescences to 8 mm long, oblong to oblanceolate-spatulate leaves with glabrous surfaces and ciliate margins with simple and long-stalked furcate trichomes, obovate, subtruncate petals 3.5–4.5 mm long and ca. 2 mm wide, and anthers 0.6–0.7 mm long. In contrast, *D. spruceana* has bracteate (at least along the lower third), racemose infructescences to 4 cm long, ovate to ovate-oblong leaves with sparsely pubescent surfaces and margins with long-stalked cruciform trichomes, spatulate, shallowly emarginate petals 2.2–2.8 mm long and 0.8–1.2(–1.5) mm wide, and anthers 0.3–0.4 mm long.

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Three New Species of *Masdevallia* (Orchidaceae) from South America

Carlyle A. Luer
Missouri Botanical Garden, P.O. Box 299, St. Louis, Missouri 63166, U.S.A.

ABSTRACT. The following three species described as new in *Masdevallia* represent three sections of subgenus *Masdevallia*. *Masdevallia goliath* is a successively flowered, round-stemmed species of section *Coriaceae* subsection *Durae*. *Masdevallia mascarata* is a member of section *Polyanthes* subsection *Alaticaules*, distinguished by triquetrous peduncles. *Masdevallia ricii* is a member of subsection *Saltatrices*, noted for the long sepaline tubes, of section *Masdevallia*.

Masdevallia goliath Luer & Andreetta, sp. nov. TYPE: Ecuador. Prov. of Morona–Santiago: epiphytic, near Bomboiza, alt. 1,700 m, collected by A. Andreetta, flowered in cultivation at Paute, 24 May 1988, *C. Luer 13629* (holotype, MO). Figure 1.

Species haec *Masdevalliae ayabacanae* Luer affinis, sed sepalorum caudis longioribus illis lateralium approximatis, petalis minute asperatis et labelli marginibis apicalibus valde revolutis differt.

Plant medium to large, epiphytic, caespitose; roots coarse. Ramicauls stout, erect, 2–3 cm long, enclosed by 2–3 tubular sheaths. Leaf erect, thickly coriaceous, narrowly obovate, obtuse, 10–23 cm long, 2.5–3.5 cm wide, gradually narrowed below into an indistinctly petiolate base. Inflorescence a congested, successively few-flowered raceme borne by a terete, purplish, ± horizontal to ascending or descending peduncle 20–35 cm long, with 2–3 close bracts below the middle, from low on the ramicaul; floral bract tubular, 15 mm long; pedicel 10–15 mm long; ovary 10 mm long; sepals fleshy, dark red-purple, glabrous externally, minutely glandular-pubescent within, the dorsal sepal narrowly triangular-ovate, 20–30 mm long, 12–15 mm wide, the acute apex attenuated into a slender, erect, orange to green tail 6–9 cm long, connate to the lateral sepals for 6–9 mm to form a short, conical tube, the lateral sepals ovate, oblique, ca. 35 mm long, ± prominently veined within, connate 17–23 mm into a concave lamina, 26–34 mm wide, the acute apices approximate and attenuated into tails 5–9 cm long; petals cartilaginous, yellow, dotted with purple, minutely asperate-verrucose, broadly oblong, shortly unguiculate, 5.5 mm long, 3.25 mm wide, the truncate apex bilobed with a thick, obtuse apiculum in the sinus, both halves callous, shallowly sulcate centrally; lip yellow-orange, dotted with red-purple, thick, oblong-ligulate, 6 mm long, 2.75 mm wide, the apical third thickened, verrucose, with revolute margins, the apex rounded with a thick, verrucose callosity beneath, the disc shallowly sulcate, the base subcordate, hinged beneath; column cream-colored, stout, semiterete, 4 mm long, the foot thick with a very short, incurved extension.

Other specimens examined. PERU. AMAZONAS: near Tarapoto, collected by M. Arias, flowered in cultivation by W. Rhodehamel at Hoosier Orchid Co., Indianapolis, Indiana, *W. Rhodehamel s.n.* (MO).

Etymology. Named for the Philistine giant Goliath.

This large, robust species occurs locally in cloud forests of southeastern Ecuador and northeastern Peru. It is closely allied to the Peruvian *Masdevallia ayabacana* from the mountains of northwestern Peru, but *M. goliath* is distinguished by the flowers with longer sepaline tails. The apices of the lateral sepals are approximate so that the bases of the tails touch in the natural position. The angle between the apices of the lateral sepals of *M. ayabacana* is obtuse.

The cartilaginous petals are minutely exasperate on the margins and nearby. The petals of *M. ayabacana* are smooth. The margins of the verrucose apical third of the lip are acutely revolute resting against a prominent tuberosity beneath the apex.

Masdevallia mascarata Luer & Vásquez, sp. nov. TYPE: Bolivia. Santa Cruz: epiphytic in moist forest south of Yapacaní, alt. 650 m, 7 Sep. 1991, *C. Luer, J. Luer, L. Moreno & D. Ric 15402* (holotype, MO; isotypes, AMES, LPB). Figure 2.

Species haec *Masdevalliae auropurpureae* Reichb. f. affinis, sed pedunculo ascendenti vel horizontali, synsepalo ovato et labello lateriore differt, etiam *M. zahlbruckneri* Krzl. persimilis, sed pedunculo triquetro, petalis oblongis et labello plicato differt.

Plant small to medium in size, epiphytic, caespitose; roots slender. Ramicauls slender, erect, 0.5–1.5 mm long, enclosed by 2–3 thin, tubular sheaths.

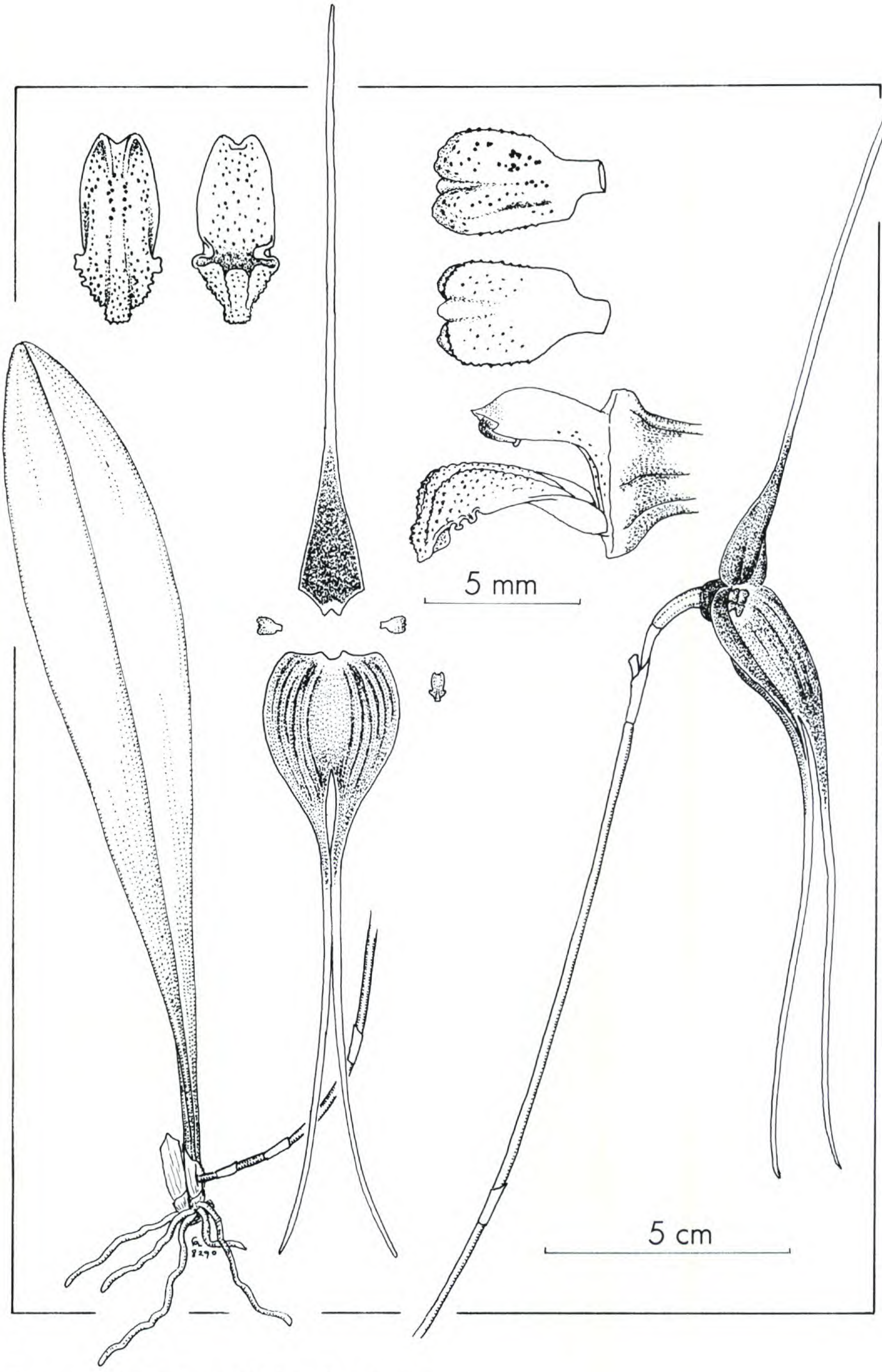


Figure 1. *Masdevallia goliath* Luer & Andreetta.

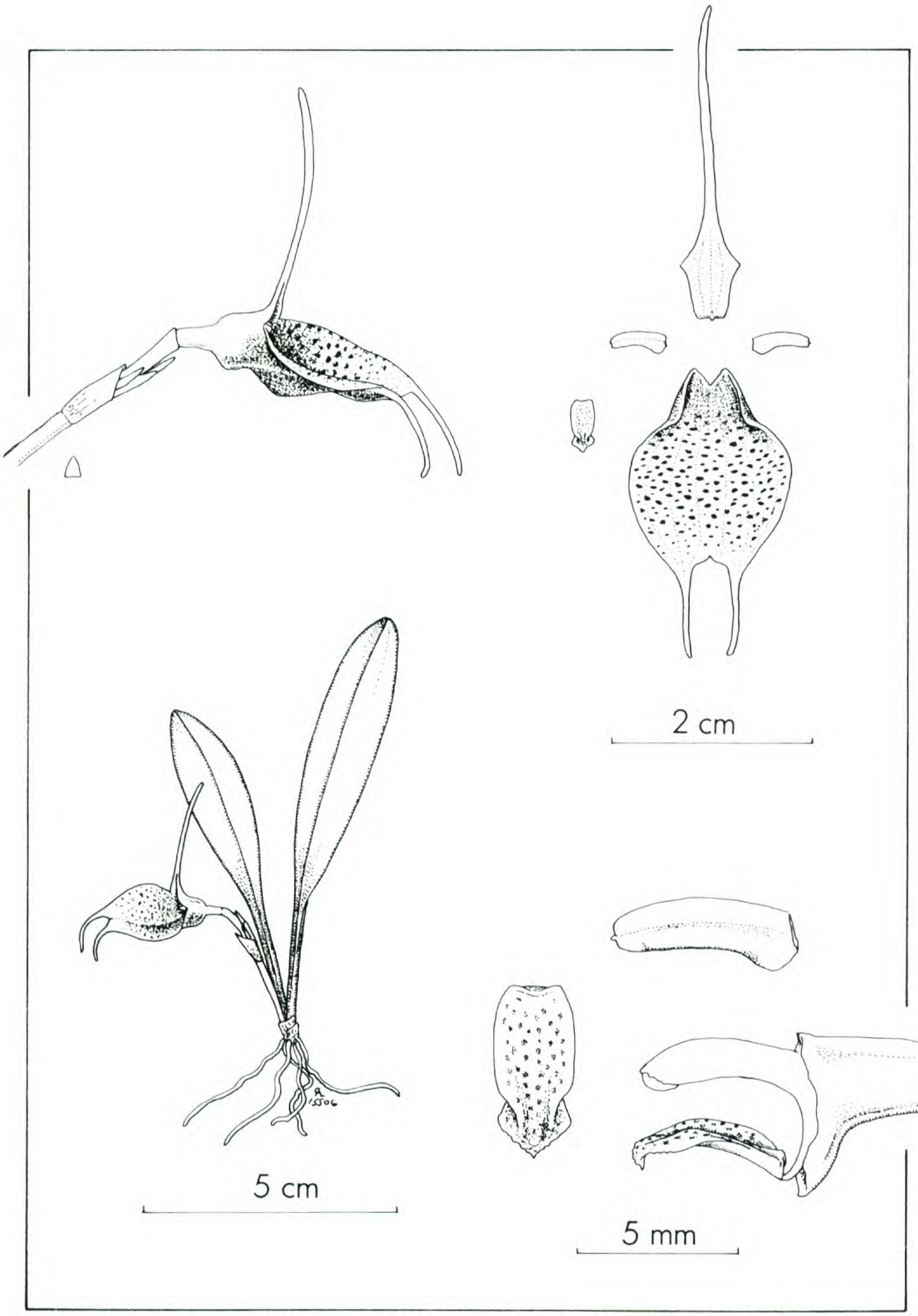


Figure 2. *Masdevallia mascarata* Luer & Vásquez.

Leaf erect, coriaceous, subpetiolate, 3–7.5 cm long including the petiole 0.5–1.5 cm long, the blade narrowly elliptical, subacute, 0.8–1.5 cm wide, the base narrowly cuneate into the petiole. Inflorescence a solitary flower, produced successively in a loose, few-flowered raceme, borne by a suberect, ascending to horizontal, triquetrous peduncle, up to 5 cm long including the peduncle 1.5–3 cm long, with a bract at the base, from the base of a ramicaul; floral bract 5–7 mm long; pedicel 7–13 mm long; ovary 2–3.5 mm long; sepals yellow, microscopically sparsely pubescent within, the dorsal sepal obovate, 7–8 mm long, 4–6 mm wide, connate to the lateral sepals for 4.5–6 mm to form a short, sepaline tube, the apex broadly obtuse, contracted into an erect, stout, yellow tail 12–23 mm long, the lateral sepals diffusely dotted with red-purple, coalescing toward the base, suffused with red-purple externally, 12–20 mm long, connate 10–17 mm into an ovate, bifid lamina 10–16 mm wide, the apices acute, contracted into subapproximate, slender tails 6–9 mm long; petals yellow, oblong, 5–6 mm long, 1.5 mm wide, the apex subtruncate, obscurely bilobulate, the labellar half longitudinally thickened ending in a low, rounded callus above the base; lip yellow, dotted with purple, oblong-subpandurate, 4.5–5 mm long, 1.5–2.25 mm wide, with oblique marginal folds above the middle, the apical portion broadly ovate, obtuse, minutely subverrucose and erose, the lower portion oblong, the disc shallowly channeled, the base truncate, thick and deep, presenting a flat, subquadrate surface on the end, hinged beneath; column yellow, stout, semiterete, 4–5 mm long, with a foot 2–3 mm long including a short extension.

Other specimens examined. BOLIVIA. NEAR SANTA CRUZ WITHOUT SPECIFIC LOCALITY: collected by L. Moreno, cultivated by Springdale Orchids, Cincinnati, Ohio, flowered in cultivation by Hoosier Orchids, Indianapolis, Indiana, July 1991, *C. Luer 15506* (MO).

Etymology. From the Greek *maskaratos*, "masked," in allusion to the confusing identity.

This species occurs in the warm, moist lowlands of central Bolivia. Although it appears deceptively similar to *Masdevallia zahlbruckneri*, known to occur farther west in central Bolivia, it is more closely related to *M. auropurpurea*, previously known only from the lower altitudes in the Eastern Cordillera of Colombia. However, *M. auropurpurea* has recently been discovered in the Alto Beni province of La Paz, Bolivia. The peduncle of *M. mascarata* is triquetrous (triangular in cross section), placing it in section *Polyanthes*. The oblong petals with a low, basal callus, and the plicated lip confirm placement in this section.

Masdevallia mascarata is distinguished by a loose, successively few-flowered raceme, similar to that of *M. zahlbruckneri*, but more erect with the peduncle triquetrous as in *M. auropurpurea*. The peduncle of *M. zahlbruckneri* is round in cross section. Superficially, the yellow, purple-dotted flower of *M. mascarata* looks exactly like that of *M. zahlbruckneri*, but when bleached colorless, it is similar to the flowers of *M. auropurpurea* or *M. bicolor* and their relatives.

The lip of *M. zahlbruckneri* is oblong with a pair of low, longitudinal carinae, and a subcordate base. The lip of *M. mascarata* is plicate above the middle, and the base is thick and more or less flat on the end, a curious feature also found in other Bolivian species (e.g., *M. ricii*), but not necessarily in the same section.

Masdevallia ricii Luer & Vásquez, sp. nov. TYPE: Bolivia. Santa Cruz: epiphytic in moist forest above Mairana, La Yunga, alt. 2,090 m, 8 Sep. 1991, *C. Luer, J. Luer, R. Vásquez & D. Ric 15416* (holotype, MO; isotype, LPB). Figure 3.

Inter species subsectionis *Saltatrices* species haec tubo sepalorum flavo aureosuffuso arcuato non ventricoso, petalorum dente longo incurvo, labelli arcuati base profunda differt.

Plant medium in size, epiphytic, caespitose; roots coarse. Ramicauls blackish, slender, erect, 1.5–3 mm long, enclosed by 2–3 thin, tubular sheaths. Leaf erect, coriaceous, petiolate, 5–12 cm long including the petiole 1.5–3 cm long, the blade narrowly elliptical, subacute, 1.2–2.2 cm wide, the base narrowly cuneate into the blackish petiole. Inflorescence a solitary flower, borne by a slender, erect peduncle 1.5–4 cm long, with a bract above the base, from low on the ramicaul; floral bract 7–8 mm long; pedicels 5–10 mm long; ovary 5 mm long; sepals pale yellow, suffused with orange and with a few small, red spots toward the base, glabrous externally, pubescent within above the middle, the trichomes simple or caespitose, the dorsal sepal narrowly obovate, concave, 14–15 mm long, 5 mm wide expanded, connate to the lateral sepals for 13–14 mm to form an arcuate, sepaline tube, the apex broadly obtuse, abruptly contracted into a forwardly directed, slender, olive-colored tail 25–27 mm long, the lateral sepals 15 mm long, connate 10 mm into a bifid, ± obovate lamina, the free portions 6 mm wide, obtuse, contracted into tails similar to that of the dorsal sepal; petals light yellow-orange, oblong-obovate, 4.5 mm long, 1.5 mm wide, the apex

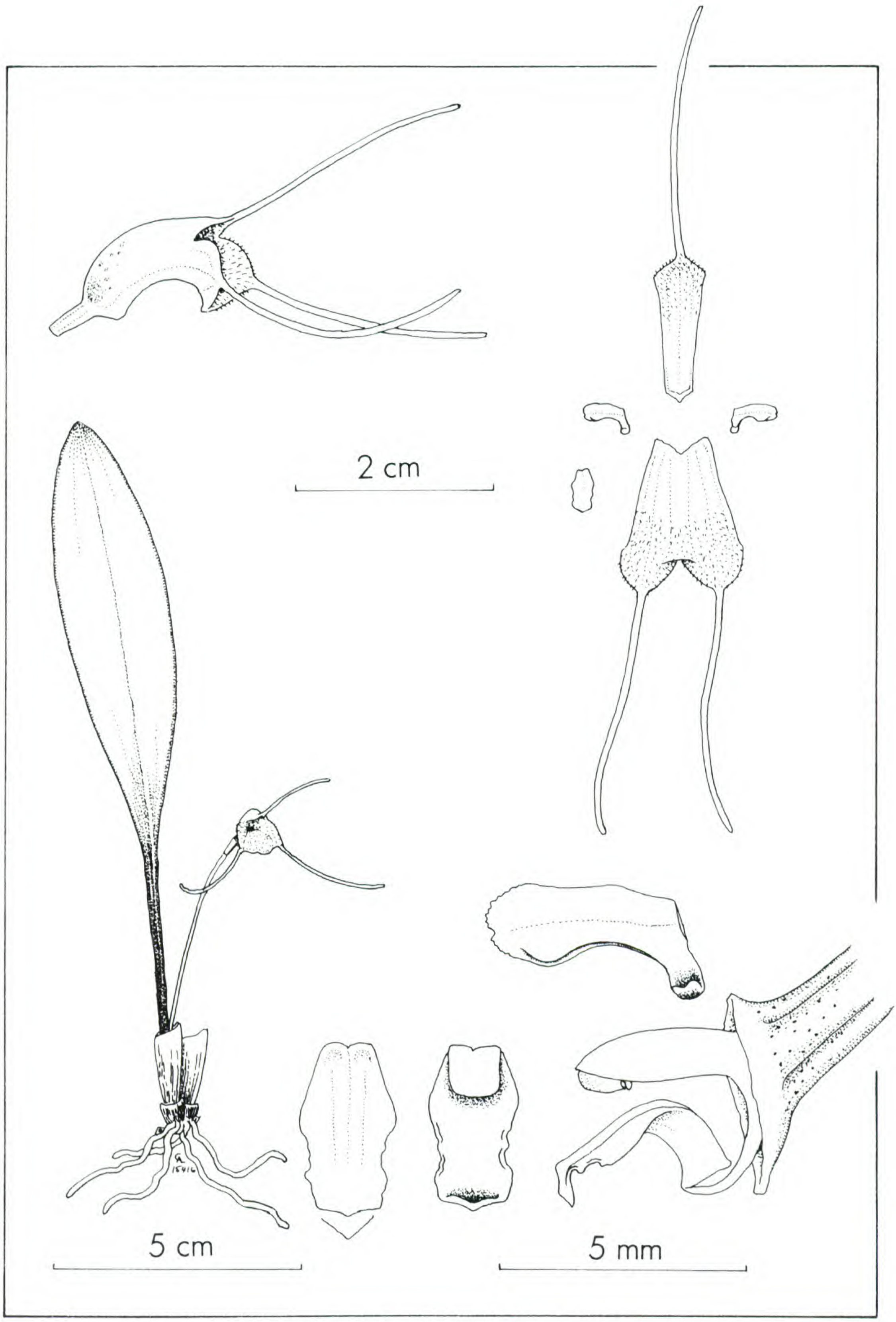


Figure 3. *Masdevallia riccii* Luer & Vásquez.

rounded, minutely erose, lightly notched, with a longitudinal carina along the labellar margin terminating at the base in a broad, thick, descending process with the tip incurved; lip yellow-orange, oblong, arcuate, 4 mm long, 1.75 mm wide, the sides undulate and decurved, the apex obtuse and decurved, the disc shallowly channeled, the base thick and deep, presenting a flat, subquadrate surface on the end, hinged beneath; column yellow-orange, stout, semiterete, 3 mm long, with a foot equally long including a slender extension 1.5 mm long.

Etymology. Named in honor of Darwin Ric of Montero, Bolivia, co-discoverer of this species.

This species occurs in cool moist forests of central Bolivia where it grows with *M. heideri* Königer, but much less abundantly. Unfortunately, these forests are currently in the process of being cut and burned.

Among the species of subsection *Saltatrices*, *M. ricii* is distinguished by the light yellow, long, arcuate, nonventricose, sepaline tube, suffused with orange and lightly dotted with red toward the base. The free portions of the sepals are rounded and contracted into slender, forwardly pointing tails. The petals are distinguished by a long, thick, basal process. The lip is arcuate and thick at the base with a broad, flat surface on the end.

Dos Nuevas Especies de *Nototriche* (Malvaceae) del Perú

Magda Chanco
Herbario San Marcos, Museo de Historia Natural, Universidad Nacional Mayor de San Marcos,
Apartado 14-0434 Lima, Perú

RESUMEN. Se describen y se ilustran dos nuevas especies del género *Nototriche: N. antoniana* y *N. peruviana*. Caracteres morfológicos, incluyendo una estuctura a manera de "corona," que las diferencian de las demás especies del género se presentan en una tabla.

ABSTRACT. Two new species of the genus *Nototriche* are described and illustrated: *N. antoniana* and *N. peruviana*. Morphological characters, including a "corona"-like structure, which differentiate them from the other species in the genus, are presented in a table.

Durante la revisión del material peruano del género *Nototriche* Turcz. depositado en el Herbario San Marcos (USM) observé un ejemplar proveniente del distrito La Unión, departamento de Huánuco, cuyas flores presentaban en la base del tubo estaminal una estructura a manera de "corona." Este carácter había sido observado hasta entonces en una sola especie peruana proveniente del departamento de Puno, *N. cupuliforme* Krapovickas (1953).

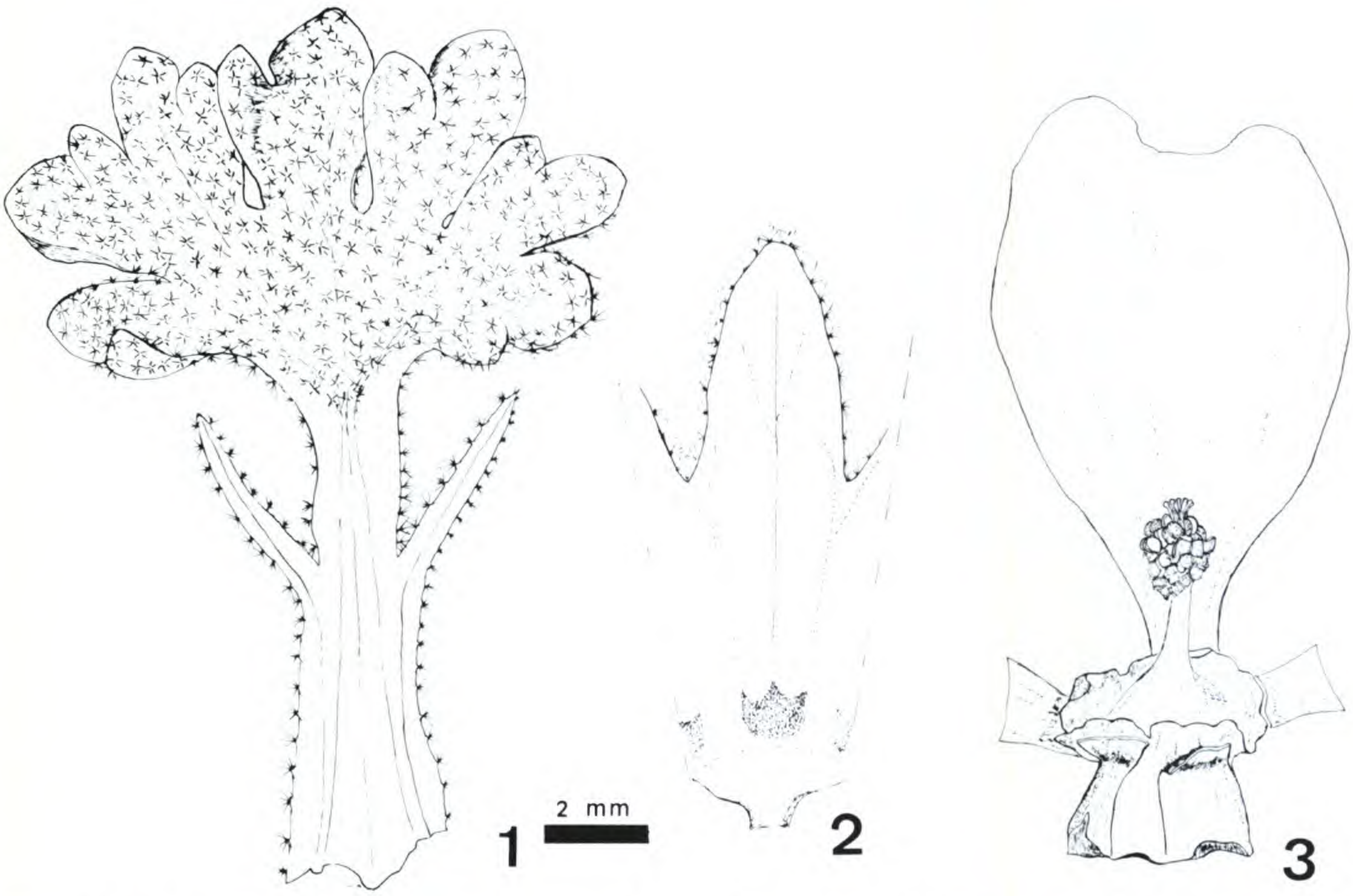
En un viaje que realicé a la localidad de Huayllay, departamento de Pasco, colecté otra especie de *Nototriche* con estructura similar en la base del tubo estaminal. Al ser cuidadosamente estudiados los ejemplares indicados, pude apreciar que tenían características únicas, que los diferenciaban de las demás especies conocidas del género.

Por lo tanto, las dos nuevas especies se describen aquí a continuacíon.

Nototriche antoniana sp. nov. TIPO: Perú. Huánuco: Provincia Dos de Mayo, La Unión, piso subnival, sep. 1956, *A. Cardich s.n.* (holotipo, USM 42520). Figuras 1–3.

Herba perennis, acaulis, basi rosulata, caudex subterraneus crassus, lignosus, ramificatusque, folia plurima arcte aggregata. Stipulae petiolo adnatae et cum eo vaginam 5–6 mm longam et 4 mm latam formantes, pars libera stipularum linearis, apice subacuto, 3–6 mm longo, 1 mm lato. Lamina flabellata, 5–7 mm longa, 7–11 mm lata, 5–7-lobata, lobis primariis trilobis, supra subtusque incano-tomentosa, interdum subtus glabra (pilis caducis ?). Petiolus pilis albis stellatis obsitus, stipulae et vagina praeter marginem glabrae. Flos solitarius subsessilis petiolo infra medium inserto. Caliculus nullus. Calyx campanulatus, 10–12 mm longus, dentibus 5 mm longis, 2.5 mm latis in apicibus subacutis, extus tanquam lamina pilis obsitus, intus glaber, praeter apices. Nectaria interiora 5, libera 1 mm longa; 1.5 mm lata. Corolla glabra. Petala 10–12 mm longa et 6–8 mm lata, apice retusa, basi in tubum coalita, tubus supra patelliformis. Antherae in capite globoso congestae. Stigmata 10, capitata. Carpella 10, monosperma, pilis longis stellatis valde obtecta. Fructus non vidi.

Hierba perenne, acaule, arrosetada, de 11–25 cm de longitud; eje subterráneo leñoso, ramificado, en cuyos ápices de las ramas se agrupan numerosas hojas formando rosetas de 3 cm de diámetro. Estípulas y peciolo forman una vagina de 5–6 mm de longitud y 4 mm de ancho en la base, disminuyendo ligeramente hacia el ápice. Parte libre de las estípulas linear, de ápice subagudo, 3–6 mm de longitud, 1 mm de ancho. Lámina flabeliforme, 5–7-lobada, segmentos trilobados; 5–7 mm de longitud, 7–11 mm de ancho. Epifilo de la lámina incano-tomentoso, hipofilo igualmente piloso, en algunas hojas es glabro (pelos caducos ?). Superficies del peciolo pilosas, pelos estrellados blanquecinos; superficies de las estípulas y vagina glabras menos los bordes. Flor solitaria subsésil, ubicada cerca al punto de separación de las partes libres de las estípulas. Calículo nulo. Cáliz campanulado, 10–12 mm de longitud; dientes 5 mm de longitud, 2.5 mm de ancho en la base, ápice subagudo; exteriormente todo piloso, interior glabro menos los ápices de los dientes. Nectarios internos basales 5, aislados, más anchos que largos (escutiformes), cerca de 1.5 mm de ancho, 1 mm de longitud. Corola azulada (blanquecina en el material herborizado). Pétalo, 10–12 mm de longitud, 6–8 mm de ancho, con una pequeña escotadura apical, glabro; cada pétalo se continúa sobre el tubo de la corola formando dos pequeñas "alas"; tubo de la corola de 3 mm de longitud. En el punto de inserción de los pétalos sobre el tubo de la corola se desarrolla una estructura pateliforme de contorno ondulado, carente de venación, a manera de "corona," que contiene al tubo estaminal, de 1.5 mm de alto y 4 mm de diámetro. Anteras dispuestas en masa globosa en el ápice del tubo estaminal; éste glabro, más corto que los pétalos, de 5 mm de longitud. Estigmas capitados 10; carpelos



Figuras 1–3. *Nototriche antoniana* Chanco. —1. Hoja. —2. Cara interior del cáliz, mostrando un nectario. —3. Corola con 4 pétalos seccionados, mostrando la "corona" en la base del tubo estaminal. Dibujado del holotipo.

10 uniovulados, pilosos desde su base, con pelos estrellados largos. Fruto maduro desconocido.

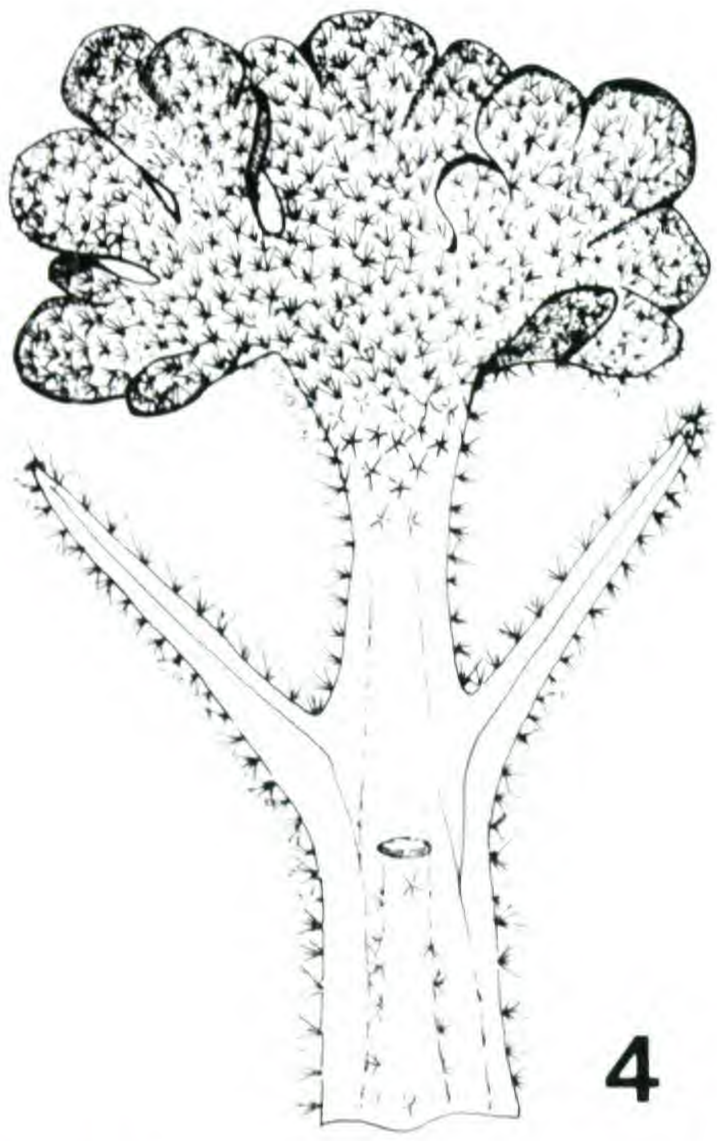
Material adicional estudiado. PERÚ. HUÁNUCO: Provincia Dos de Mayo, cumbre de Pachacoto–Wansala, 24 feb. 1980, *M. Weibel 6* (USM); Pachacoto–La Unión, 19 Mar. 1983, *O. Tovar & S. Rivas 9779, 9786, 9788* (USM); Valle de Huallanca, *O. Tovar & S. Rivas 9913* (USM).

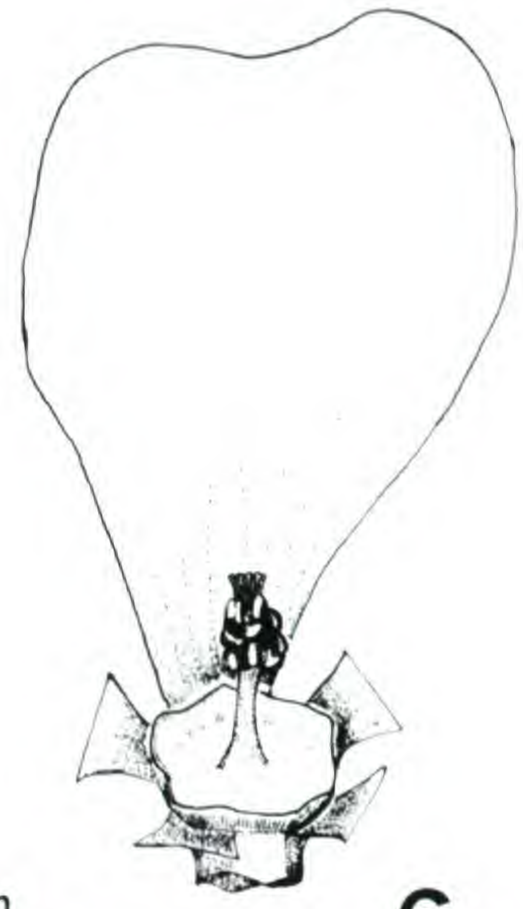
Distribución geográfica. Esta especie ha sido coleccionada hasta la fecha en el departamento de Huánuco, entre los 4,200 y 4,780 m.

La autora ha dedicado esta especie al eminente científico Antonio Krapovickas, en reconocimiento a su constante estudio de las Malváceas, aportando para el Perú numerosas publicaciones de géneros y especies nuevos.

TABLA 1. Caracteres que distinguen las tres especies de *Nototriche.*

	N. cupuliforme	*N. antoniana*	*N. peruviana*
Lámina	Pinatífida	Flabeliforme	Flabeliforme
Indumento de las hojas	Glabro	Piloso	Piloso
Cáliz (longitud)	4–5 mm, glabro	10–12 mm, piloso	7–10 mm, piloso
Nectarios	Semicirculares, 0.5 mm ancho	Escutiformes, 1.5 mm ancho	Triángulares, 1 mm ancho
Corola	Rojo-vinosa	Azulada	Rojo-vinosa
"Corona" (diámetro)	Cupuliforme, 2.5 mm	Pateliforme, 4 mm	Pateliforme, 3 mm
Tubo de la corola (longitud)	1.5 mm	3 mm	1–1.5 mm
Tubo estaminal (longitud)	2–2.5 mm	5 mm	1.5 mm
Estigmas	6 capitados	10 capitados	8 capitados
Distribución	Puno: Carabaya	Huánuco: La Unión	Pasco: Huayllay





Figuras 4–6. *Nototriche peruviana* Chanco. —4. Hoja. —5. Cara interior del cáliz, mostrando tres nectarios. —6. Corola con 4 pétalos seccionados, mostrando la "corona" en la base del tubo estaminal. Dibujado del holotipo.

Las especies más próximas a *N. antoniana* son *N. cupuliforme* Krapov. y *N. peruviana*. (Ver Tabla 1.)

Nototriche peruviana sp. nov. TIPO: Perú. Pasco: Provincia de Pasco, Huayllay piso subnival, 10 mayo 1976, *M. Chanco 368* (holotipo, USM; isotipo, CTES). Figuras 4–6.

Herba perennis, rosulata, caudex subterraneus, lignosus. Stipulae petiolo adnatae et cum eo vaginam 5–7 mm longam et 2 mm latam formantes, pars libera stipularum linearis, apice obtuso, 3.5–5 mm longo, 0.5 mm lato. Lamina flabelliforme 7-lobata. Flos solitarius subsessilis petiolo infra medium insertus. Caliculus nullus. Calyx campanulatus, 7–10 mm longus, dentibus 4–5 mm longis, 2–3 mm latis in apicibus obtusis, extus tamquam lamina pilis obsitus, intus praeter apices glaber. Nectaria interiora 5, libera 2 mm longa, 1 mm lata. Corolla glabra, vinosa. Petala obovata, 8 mm longa et 6 mm lata, apice retusa, basi in tubum coalita, tubus supra patelliforme. Antherae in capito globoso aggregatae. Stigmata 8, capitata. Fructus maturus non visus.

Hierba perenne, arrosetada; eje subterráneo leñoso, subcilíndrico, 15–30 cm de longitud y cerca de 1 cm de ancho en la parte superior, decrece notablemente en diámetro hacia el extremo inferior, ramificado apicalmente, con numerosas hojas dispuestas a manera de rosetas de 1.5–3 cm de diámetro. Estípulas y peciolo soldados formando una vagina de 5–7 mm de longitud, 2 mm de ancho, parte libre de las estípulas linear, de ápice obtuso, con nervio medio conspicuo, 3.5–5 mm de longitud, 0.5 mm de ancho. Lámina flabeliforme 7-lobada, segmentos 2–3-lobados, ápice de los lóbulos semicirculares; 4–5 mm de longitud, 7–8 mm de ancho, superficie inferior de toda la hoja densamente pilosa. Superficie superior del peciolo y parte basal de la vagina con pelos estrellados, el resto glabro; superficie superior de las estípulas glabra menos el ápice que es piloso. Flor solitaria subsésil, ubicada por debajo del punto donde se separan las partes libres de las estípulas. Calículo nulo. Cáliz campanulado, acrescente, 7–10 mm de longitud, cubierto exteriormente por pelos estrellados similares a los de la hoja, 5 dentado, los dientes 4–5 mm de longitud, 2–3 mm de ancho, obtusos, el interior glabro menos los ápices y bordes de los dientes. Nectarios internos aislados, triángulares, de ápice obtuso, 2 mm de longitud, 1 mm de ancho. Corola rojo-vinosa; tubo de la corola de 1.5 mm de longitud; pétalos obovados con ápice ligeramente escotado, glabros, 8 mm de longitud, 6 mm de ancho, cada pétalo se continúa sobre el tubo de la corola formando dos pequeñas "alas"; sobre el punto donde se unen los pétalos al tubo de la corola, se desarrolla una estructura carnosa 5 lobada a manera de "corona" (pateliforme), que contiene al tubo estaminal, de 3 mm diámetro y 1 mm de alto. Tubo estaminal de 1.5 mm de longitud. Anteras reunidas en una masa globosa. Estigmas capitados en número de 8. Ovario cónico, piloso, pelos largos desde la base. Fruto maduro no visto.

Material adicional estudiado. PERÚ. PASCO: Huayllay, pajonal del Bosque de Piedra, *N. Urquizo s.n.* (USM).

Distribución geográfica. Sólo se conoce esta especie de la localidad tipo.

Por la presencia de una estructura a manera de "corona" en la base de inserción de los pétalos al tubo estaminal, esta especie tiene afinidad con *N. cupuliforme* y *N. antoniana*. Las características de diferenciación de las 3 especies se resumen en la Tabla 1.

Agradecimiento. Parte de este estudio se realizó durante mi estadía en el Departamento de Botánica y Ecología de la Universidad Nacional del Nordeste, Corrientes, Argentina. Expreso mi sincera gratitud a Antonio Krapovickas, Director del Instituto de Botánica, por el asesoramiento y las facilidades brindadas en el estudio de la familia Malvaceae duranto mi estadía en Corrientes. A Jaroslav Soukup, mi agradecimiento póstumo por la diagnosis en latín de las nuevas especies. Al personal directivo de la Compañía Minera de Huarón, por facilitarme la estadía durante mi trabajo de campo en Huayllay.

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Two New Species of *Jungia* (Compositae) from Peru

Gunnar Harling
Department of Systematic Botany, University of Göteborg, Carl Skottsbergs Gata 22, S-413 19 Göteborg, Sweden

ABSTRACT. Two new species of *Jungia*, *J. schuerae* and *J. gracilis*, from the Peruvian Andes are described and illustrated, and their affinities are briefly discussed.

The genus *Jungia* L. f. (Compositae: Mutisieae: Nassauviinae) comprises 25–30 species, ranging from southern Mexico through Central America and following the South American Andes to northern Argentina; a couple of species are known from southeastern Brazil and Paraguay. In connection with my work on a monograph of the genus, I have found the following two species to be new to science.

Jungia schuerae Harling, sp. nov. TYPE: Peru. Lima: Prov. Huarochirí, Matucana, dry slope, 2,400 m, 26 May 1940, *Asplund 11101* (holotype, S). Figure 1A.

Frutex a basi ramosus, erectus vel reclinatus, 1–1.5(–2.5) m altus, ramis sparse vel dense pubescentibus. Folia exstipulata, petiolata, laminis chartaceis, ambitu cordato-suborbicularibus, 3.5–5 cm longis, 3.5–6 cm latis in foliis superioribus, usque ad 10 cm longis, 11 cm latis in foliis inferioribus, 5–7-lobatis, lobis acutis vel obtusis vel rotundatis, indistincte serratis vel dentatis, supra sparse vel satis dense strigosis, subtus dense villosis; petiolus 1–3(–4.2) cm longus, dense pubescens. Synflorescentia dense paniculata, polycephala. Involucrum campanulatum, 6–7 mm longum, 7–8 mm latum, phyllariis circiter 12, oblongis vel lanceolatis, acuminatis, 5–6 mm longis, 1–1.2 mm latis, basi plusminusve callosis, dorsaliter tomentosis. Flores circiter 17–25, corolla sulphurea, tubo 4–5 mm longo, labio exteriore tridentato, in floribus marginalibus liguliformi, 3–3.5 mm longo, in floribus centralibus revoluto, 2.5–2.8 mm longo, labio interiore profunde bipartito, 1.6–2.3 mm longo, segmentis convolutis. Achenium subcylindricum vel fusiforme, erostratum, circiter 4 mm longum, sparse strigosum, pappi setis niveis, 30–35, circiter 6 mm longis, ciliatis vel breviter plumosis.

Erect or slightly reclinate shrub 1–1.5(–2.5) m high, branched from the base. Branches terete to slightly angular, light brown, sparsely to densely white-pubescent, in older stages glabrescent, often with dark brown to black lenticels, eglandular like the rest of the plant. Leaves exstipulate, petiolate; lamina chartaceous, suborbicular-cordate in outline, 3.5–5 cm long and 3.5–6 cm wide in upper leaves, to 10 cm long and 11 cm wide in lower leaves, 5–7-lobed, lobes acute to obtuse or rounded, indistinctly serrate or dentate with mucronate, dark teeth, rarely slightly lobulate, sparsely to rather densely strigose above, moderately to very densely white-villous beneath, rarely subglabrous on both sides, veinlet reticulum beneath dark-colored, usually with reddish brown thickenings; petiole 1–3(–4.2) cm long, slightly sheathing at base, densely white-pubescent. Synflorescence usually a very dense, occasionally ± open panicle; bracts similar to ordinary leaves but gradually smaller, seldom rounded and unlobed; peduncles 0.2–1.3(–3) cm long, white-pubescent, with 0–2 small, linear bracteoles. Involucre campanulate, 6–7 mm long, 7–8 mm wide; accessory bracteoles usually 3–6, 2–3 mm long, ca. 0.5 mm wide, linear to narrowly oblanceolate, white-pubescent; phyllaries (10–)12(–13), 5–6 mm long, 1–1.2 mm wide, oblong to lanceolate, acuminate, ± callose at base, moderately to densely white-tomentose dorsally, green, occasionally with purple tips; paleae similar to phyllaries but thinner and pubescent only apically and along midnerve. Florets 17–25, corolla pale yellow, often fading to white, tube 4–5 mm long, gradually widening toward mouth, outer lip tridentate, apically slightly pilose, in marginal florets liguliform, 3–3.5 mm long, straight to slightly revolute, in central florets 2.5–2.8 mm long, revolute, inner lip deeply bifid, 1.6–2.3 mm long, the segments curled. Achenes subcylindric to fusiform, without beak, ca. 4 mm long, 5-ribbed, dark between the ribs, with short, hyaline hairs; pappus white, bristles ca. 30–35, ca. 6 mm long, ciliate to short-plumose.

Jungia schuerae is a rather uniform and easily recognized species, distantly related to *J. paniculata* (DC.) Gray. It seems to be locally common in Cajamarca, La Libertad, Ancash, Huánuco, and Lima. The habitat is, according to the collectors, dry, gravelly, or stony open slopes or dry thickets at 2,200–3,600(–4,000) m elevation. Currently about 50 collections, most of them from Ancash and Lima, are known to me. A complete list will be published in my forthcoming monograph of the genus.

Cerrate (1951), who treated the Peruvian species of *Jungia*, confused this species with *J. paniculata*.

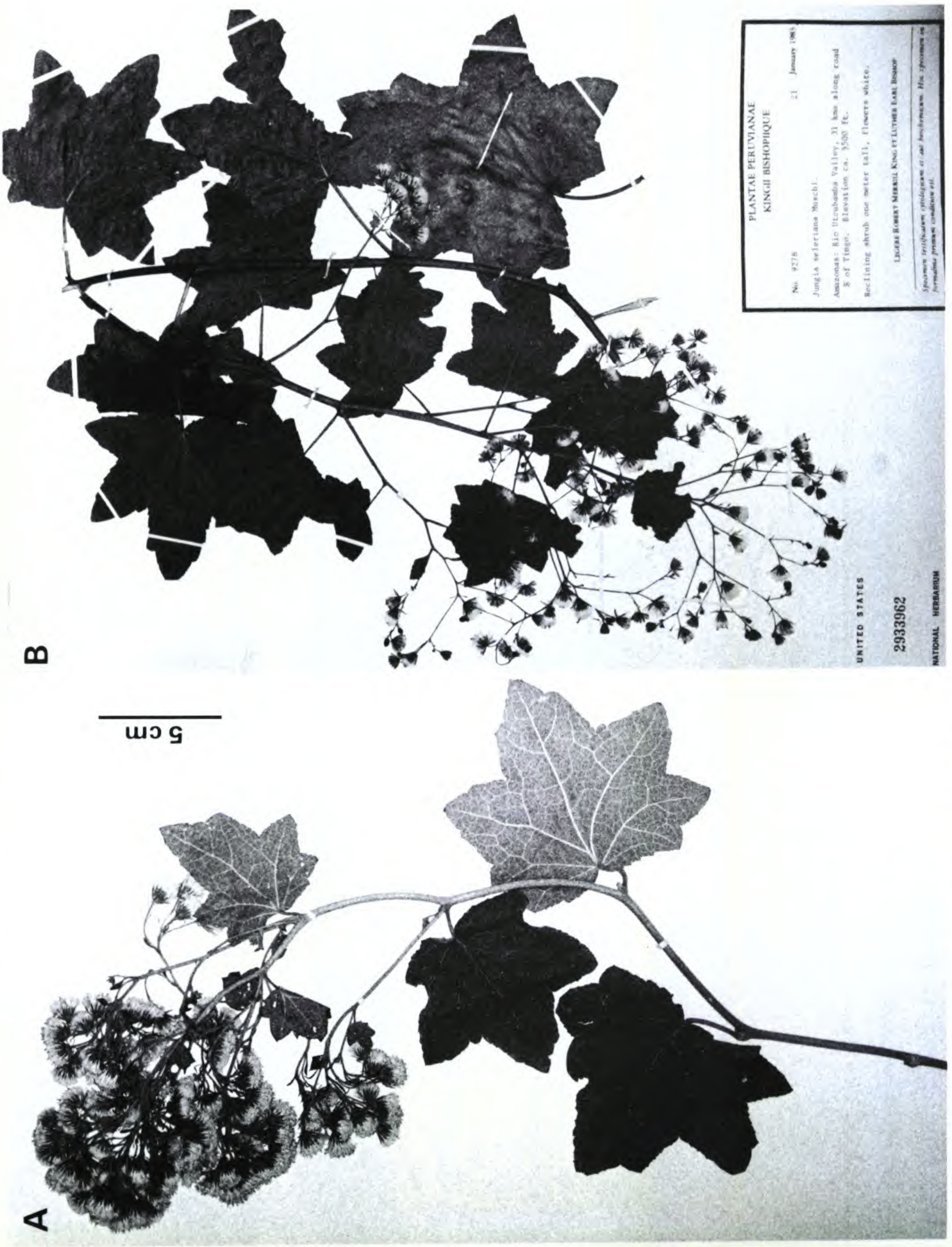

Figure 1. Holotypes of *Jungia schuerae* Harling (A) and *Jungia gracilis* Harling (B).

The latter species is, however, an entirely different plant with stipulate leaves, open synflorescences, usually glandular peduncles and phyllaries, white florets, and a distinctly plumose pappus. The true *J. paniculata* is common in Ecuador and Colombia, but seems to be rare in Peru. Apart from the type, I have so far seen only three collections, all from Cajamarca.

It is with great pleasure that I name this species in honor of Mrs. Gudrun Nilsson, née Schuer, who during her careful, but unfortunately unpublished, studies of the genus pointed it out as new (Schuer, in sched.).

Jungia gracilis Harling, sp. nov. TYPE: Peru. Amazonas: Prov. Chachapoyas, Río Utcubamba Valley, 31 km along road S of Tingo, ca. 1,700 m, 21 Jan. 1983, *King & Bishop 9278* (holotype, US; isotypes, G, K, MO). Figure 1B.

Suffrutex sparse ramosus, erectus vel reclinatus, raro subscandens, 1–1.5 m altus, ramis lentis, glabris. Folia exstipulata, petiolata, laminis membranaceis, ambitu cordato-suborbicularibus, 4–9.5 cm longis, 4.5–10 cm latis, 5–7-lobatis, lobis acutis, indistincte serratis vel dentatis, supra glabris, subtus sparse vel mediocriter villosis; petiolus 1.5–5(–7) cm longus, glaber vel sparse puberulus. Synflorescentia laxissime paniculata, polycephala, ambitu ad 25 × 30 cm. Involucrum turbinatum, 4–5 mm longum, 4–5.5 mm latum, phyllariis circiter 12, oblongis vel oblanceolatis, acuminatis, 4.5–5 mm longis, 1–1.2 mm latis, basi distincte callosis, dorsaliter glabris vel sparse puberulis apice penicillatis. Flores 16–20(–23), homomorphi, corolla nivea, tubo 2.6–3 mm longo, labio exteriore tridentato, 1–1.3 mm longo, revoluto, labio interiore profunde bipartito, 0.5–0.8 mm longo, segmentis convolutis. Achenium subcylindricum vel ampullaceum, erostratum, 3.5–4 mm longum, sparse strigosum, pappi setis niveis, circiter 30, 4.5–5 mm longis, ciliatis.

Erect or reclinate, seldom clambering subshrub 1–1.5 m high. Stem and branches terete, slightly fluted, rather weak, reddish brown, glabrous, eglandular like the rest of the plant. Leaves exstipulate, petiolate; lamina membranaceous, suborbicular-cordate in outline, 4–9.5 cm long, 4.5–10 cm wide, 5–7-lobed, lobes acute, indistinctly serrate or dentate with mucronate, dark teeth, glabrous to subglabrous above, sparsely to moderately villous beneath, veinlet reticulum beneath dark-colored with partial thickenings; petiole 1.5–5(–7) cm long, slightly sheathing at base, glabrous to minutely puberulous. Synflorescence an open, many-headed (heads up to 200 or more) panicle, up to 25 × 30 cm in extent; branches numerous, thin, slightly pubescent; lower bracts similar to ordinary leaves but gradually smaller, upper bracts ovate to elliptic, 1–3 cm long, 0.6–1.4 cm wide, pubescent, margin entire or slightly serrate; peduncles (1–)2–3.6 cm long, slightly pubescent. Involucre turbinate, 4–5 mm long, 4–5.5 mm wide, accessory bracteoles 2–3(–4), narrrowly linear, 2–3 mm long, ciliate at margin; phyllaries ca. 12, 4.5–5 mm long, 1–1.2 mm wide, oblong to oblanceolate, acuminate, distinctly callose at base, glabrous to sparsely pubescent dorsally, pilose apically, green with reddish nerves; paleae similar to phyllaries but thinner, glabrous except pilose apex. Florets 16–20(–23), homomorphous, corolla white, tube 2.6–3 mm long, gradually widening toward mouth, outer lip tridentate, 1–1.3 mm long, revolute, inner lip deeply bifid, 0.5–0.8 mm long, the segments curled, both lips slightly pilose apically. Achenes subcylindric to slightly ampullaceous but without distinct beak, 3.5–4 mm long, 5-ribbed, light brown, with short hyaline hairs; pappus white, bristles ca. 30, 4.5–5 mm long, ciliate.

Jungia gracilis is endemic to the Chachapoyas area in Amazonas. It has been collected in rather dry and open vegetation at 1,600–2,000 m elevation. In all, six collections are known at present.

The closest relative of *J. gracilis* is probably *J. spectabilis* D. Don, known from Ecuador and northern Peru. Both species are exstipulate, eglandular subshrubs; they also have in common the leaf shape, the scarce indumentum, and the conspicuously callose-based phyllaries. But *J. gracilis* is smaller and more slender in all parts, has an extremely widely spaced synflorescence (vs. dense and partially clustered), and the veinlet reticulum beneath is entirely dark-colored (vs. light-colored with black dots).

Acknowledgments. I thank Uno Eliasson for his critical reading of the manuscript and for photographic assistance.

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Compositae of the Guayana Highlands—VI. *Huberopappus maigualidae* (Vernonieae), a New Genus and Species from Venezuela

John F. Pruski
Institute of Systematic Botany, New York Botanical Garden,
Bronx, New York 10458-5126, U.S.A.

ABSTRACT. *Huberopappus maigualidae*, a new genus and species of Compositae tribe Vernonieae from Sierra de Maigualida, Venezuela, is described and illustrated. *Huberopappus* is the only genus of the tribe with a coroniform pappus and dimorphic achenes. By its pappus *Huberopappus* is similar to *Struchium* and especially to *Ekmania* and *Gorceixia*, the latter two being taken as its closest relatives. *Huberopappus*, *Ekmania*, and *Gorceixia* seem to form a generic group and are placed near *Pollalesta* in the Vernonieae subtribe Piptocarphinae.

Among collections of Compositae submitted to me for determination by Otto Huber and Paul Berry from their recent expeditions to the previously unexplored, granitic Sierra de Maigualida in Guayanan Venezuela were specimens that could not be assigned to any genus of the family. These plants are referable to the cichorioid tribe Vernonieae, in which only three described neotropical genera have a strongly coroniform pappus. The plants from Sierra de Maigualida, however, are the only Vernonieae with both a crownlike pappus and dimorphic achenes. They are thus described as a new genus and species in conjunction with my treatment of the family for the *Flora of the Venezuelan Guayana* by Julian Steyermark and collaborators.

Huberopappus maigualidae Pruski, gen. et sp. nov. TYPE: Venezuela. Bolívar: Depto. Cedeño, Sierra de Maigualida, sector nor-oriental, altiplanicie tepuyana disectada sobre granito en las cabeceras del Río Chajura, afluente occidental del Río Erebato, aprox. 100 km (en línea recta) al SW del Campamento Entreríos, 05°33′N, 65°13′W, 2,100 m, 18 Nov. 1988, *Otto Huber & Liz Izquierdo 12791* (holotype, VEN; isotypes, MY, NY, US). Figures 1, 2.

Frutex 1–2 m altus pauciramosus; *caules* subteretes vel angulati pubescentes vel dense pubescentes nigri; *folia* simplicia alterna petiolata, lamina subcoriacea vel coriacea elliptica vel obovata (2–)3–6 × (1.3–)1.7–3.6 cm cuneata apice acuta vel rotundata integra, pinnatim venosa supra glandulosa punctata subtus trichomatibus subappressis tomentella, petiolo 4–7 mm longo; *capitulescentia* terminalis cymosa; *pedunculi* 0–7 mm longi; *capitula* homogama epaleacea, flosculis 14–22; *involucrum* campanulatum 5–7 × 3–4 mm 3–4-seriatum; *phyllaria* dimorpha imbricata, quinque externa plerumque coriacea nigra deltoidea vel elliptica dense pubescentia; *corollae* discoideae quinquelobatae 4.5–5 mm longae glandulosae, tubo 2.6–3.1 mm longo, lobis adscendentibus linearibus ca. 1.8 mm longis; *achaenia* turbinato-prismatica 2.6–3.2 mm longa glabra, pappo in corpus coroniforme serrulatum 1.7–2.1 mm longum confluenti vel arista singula 4 mm longa usque praedito.

Subshrub 1–2 m tall; *stems* erect, few-branched, subterete below, irregularly angled distally, pubescent to densely so, this pubescence imparting a blackish color to the stems; internodes 0.5–2.5 cm long. *Leaves* simple, alternate, petiolate; blade subcoriaceous to coriaceous, elliptic to obovate, (2–)3–6 cm long, (1.3–)1.7–3.6 cm wide, basally cuneate, apically acute to rounded, entire, venation pinnate, reticulate, upper surface dark green, glandular-punctate, otherwise glabrous, secondary veins slightly raised, lower surface sometimes glandular, tomentose with a dense mat of appressed trichomes, veins darker than areoles, the lower surface thereby reticulate; petiole 4–7 mm long, densely pubescent. *Capitulescence* cymose, sometimes partially obscured by juvenile leaves, of ca. 3–11 closely spaced capitula, these terminal on axillary branches from the uppermost nodes or from stem apex; *peduncles* densely pubescent, the lateral ones 2–7 mm long, the central ones often lacking; *capitula* homogamous, discoid, 14–22-flowered, often subtended by reduced, densely pubescent, black foliar bracts; *involucre* campanulate, 5–7 mm high, 3–4 mm broad, 3- or 4-seriate; *phyllaries* 14–17, imbricate; outer series deltoid to broadly elliptic, to ca. 7 × 3 mm, occasionally slightly longer than the next series, coriaceous, densely pubescent, blackish, apically acute to rounded, margins entire; innermost series elliptic to lanceolate, 6–7 mm long, 1.5–2 mm wide, proximally glabrous, stramineous, stiffly charta-

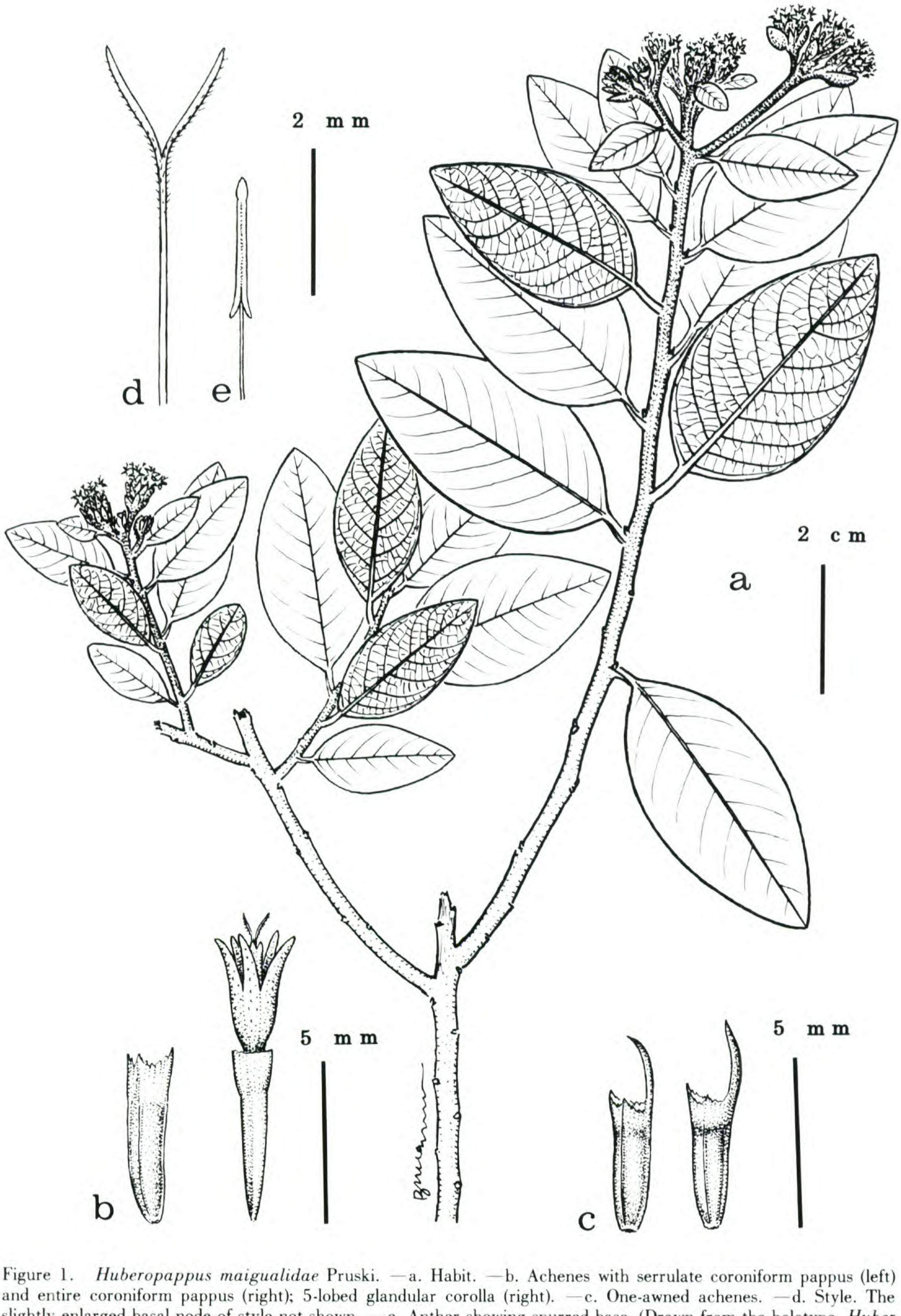

Figure 1. *Huberopappus maigualidae* Pruski. —a. Habit. —b. Achenes with serrulate coroniform pappus (left) and entire coroniform pappus (right); 5-lobed glandular corolla (right). —c. One-awned achenes. —d. Style. The slightly enlarged basal node of style not shown. —e. Anther showing spurred base. (Drawn from the holotype, *Huber & Izquierdo 12791*, VEN.)

Figure 2. *Huberopappus maigualidae* Pruski showing the closely spaced, ovate, subcoriaceous to coriaceous leaves (*Huber & Izquierdo 12791*, the type collection). Photo taken by Otto Huber.

ceous, distally black, densely pubescent, apex rounded, margins entire; *receptacle* flat, ca. 2 mm diam., naked, foveolate, inner walls occasionally elongate or pointed. *Corollas* actinomorphic, homogamous, 5-lobed, 4.5–5 mm long, abaxially glandular, especially toward apex of lobes, violet; tube (not differentiated from throat) 2.6–3.1 mm long; lobes ascending, ca. 1.8 mm long, linear; *anthers* not exserted, cream-colored, ca. 2.1 mm long, glabrous, apical appendage lanceolate, rounded apically, base calcarate, spurs fertile, 0.4–0.5 mm long; *style* to 5.5 mm long, hispidulous in the upper half, the 2 branches ascending to somewhat recurved, 1–1.5 mm long, apex rounded to attenuate, basal node only slightly expanded. *Achenes* dimorphic, turbinate, prismatic, 3–5-angled, 2.6–3.2 mm long, light brown, glabrous, ca. 10-striate; carpopodium slightly stipitate, neither sculptured nor well differentiated; *pappus* thinly coroniform, entire or serrulate apically, stramineous, ca. 1.7–2.1 mm long, but in some achenes often weakly lacerate or with an elongate outer awn to 4 mm long, this protruding from an abaxial strengthened angle of achene. *Pollen* 36–40 μm diam. (excluding spines), tricolporate, microperforate, subechinolophate (pollen type A sensu Keeley & Jones, 1979).

TABLE 1. Neotropical Vernonieae with a coroniform or annular pappus.

Character	Taxon							
	Huberopappus maigualidae Pruski	*Ekmania lepidota* (Griseb.) Gleason	*Gorceixia decurrens* Baker	*Harleya oxylepis* (Benth.) Blake	*Heterocoma albida* DC.	*Pacourina edulis* Aublet	*Rolandra fruticosa* (L.) Kuntze	*Struchium sparganophorum* (L.) Kuntze
Habit	subshrub	subshrub to shrub	shrub	herb	subshrub	herb	herb or subshrub	herb
Leaf pubescence	glandular-punctate above, tomentose below	glandular-punctate above, tomentose below	white-tomentose below	white-tomentose below	white-tomentose below	glandular above and below	white-tomentose below	puberulent and glandular below
base	petiolate	petiolate	decurrent	petiolate	subamplexicaule	subamplexicaule	petiolate	petiolate
Capitulescence	terminal, cymose	terminal, cymose	terminal, glomerate	terminal, subglomerate	axillary, sessile, solitary	axillary, sessile, solitary	axillary, sessile, glomerate	axillary, sessile, glomerate
Flowers per head	14–22	8–20	5	8–9	50 or more	50 or more	uniflorous	30–60
Outer phyllaries								
apex	acute to rounded	narrowly acute to acuminate	acuminate	aristate	aristate	aristate	aristate	aristate
texture	coriaceous	coriaceous	scarious	scarious	scarious	marginally membranous	scarious	scarious

TABLE 1. Continued.

Character	Taxon							
	Huberopappus maigualidae Pruski	*Ekmania lepidota* (Griseb.) Gleason	*Gorceixia decurrens* Baker	*Harleya oxylepis* (Benth.) Blake	*Heterocoma albida* DC.	*Pacourina edulis* Aublet	*Rolandra fruticosa* (L.) Kuntze	*Struchium sparganophorum* (L.) Kuntze
Achenes	dimorphic	isomorphic	isomorphic	isomorphic	isomorphic	isomorphic	isomorphic	isomorphic
Pappus	strongly coroniform, some achenes also one-awned	outer strongly coroniform; inner elongate, deciduous	strongly, but irregularly coroniform	weakly annular	outer annular; inner elongate, deciduous	outer annular; inner short, deciduous	coroniform, but strongly lacerate	thickly and strongly coroniform
Pollen	type A	type A	type A	echinolophate (type D or *Aynia*-type of Robinson, 1988)	type A (fide H. Robinson)	lophate	echinolophate (type D)	echinolophate (type D)
Distribution	Venezuela	Cuba	Brazil	Mexico, Belize, and Guatemala	Brazil	South America northwestward into Nicaragua	Neotropics, Java, and Japan	New and Old World tropics

Paratypes. VENEZUELA. TERRITORIO FEDERAL AMAZONAS: Depto. Atures, Sierra de Maigualida, NW sector, small valley along an upper tributary of Caño Iguana, 05°30′N, 65°15′W, 2,000 m, 28 Feb.–3 Mar. 1991, *Paul Berry, Otto Huber & Judith Rosales 4812* (MO, MYF not seen, NY, VEN not seen). BOLÍVAR: Depto. Cedeño, Sierra de Maigualida, sector nor-oriental, altiplanicie tepuyana ubicada en las cabeceras del Río Chajura, afluente occidental del Río Erebato, aprox. 100 km (en línea recta) al SW del Campamento Entreríos, 05°33′N, 65°13′W, 2,100 m, 28 Mar. 1988, *Otto Huber 12745* (K, US, VEN).

Distribution. In savannas from 2,000 to 2,100 m in the northern sector (05°30–33′N, 65°13–15′W) of Sierra de Maigualida, a granitic mountain range bordering Territorio Federal Amazonas and Estado Bolívar, Venezuela. Known to flower in November and from February to March.

I take great pleasure in naming this new genus after my friend and colleague Otto Huber, who first collected it and recognized it as a new species. The epithet refers to the Sierra de Maigualida, where this species appears to be endemic.

The Vernonieae, a tribe of about 1,500 species and 80 genera, have long been thought to be a fairly homogeneous group because of the uniformity of the style, anther, and corolla (see Gleason, 1906, 1922; Jones, 1977; Robinson et al., 1980; Robinson & Kahn, 1986; Robinson & Funk, 1987; Keeley & Turner, 1990). However, many vernonian genera differ from the prototype of the tribe by rare or unique features. *Huberopappus* Pruski is yet another morphologically distinctive genus, the only one in the Vernonieae with both a coroniform pappus and dimorphic achenes.

Seven neotropical genera previously were known to have a connate (at least outer) pappus, which ranges from deeply lacerate to entire and from strongly coroniform to annular. These genera differ greatly from typical Vernonieae, which have a single or double pappus of free awns, scales, or bristles. Achene dimorphy in the Vernonieae is rare, previously noted (H. Robinson, 1979, pers. comm.) only in the distantly related and noncoroniform *Heterocypsela* H. Robinson, *Lychnophoriopsis* Schultz-Bip. sens. str., *Pithecoseris* Martius of Brazil, and *Dipterocypsela* S. F. Blake from Colombia. All neotropical genera of Vernonieae with a coroniform pappus, as well as those with dimorphic achenes (both of these conditions are taken as derived), are unispecific.

Although the presence of a coroniform pappus is useful taxonomically, it is not necessarily an indicator of phylogenetic relationships. Nevertheless, *Ekmania* Gleason, native to limestone outcrops that arise from a serpentine bed in the mountainous Cuban Oriente (Borhidi & Muñiz, 1986; Borhidi, pers. comm.) and *Gorceixia* Baker, of the central Brazilian highlands, seem to be the closest relatives of *Huberopappus*. *Ekmania* and *Gorceixia* are related to *Huberopappus* by a terminal capitulescence, a strongly coroniform pappus, entire subcoriaceous leaves, primitive type A pollen (*Lychnophora*-type), and angled young stems. *Huberopappus* and *Ekmania* seem more closely related to each other on the basis of leaf shape, leaf pubescence, and pedicellate heads. Key traits that distinguish *Huberopappus* from *Ekmania* are dimorphic (not isomorphic) achenes, black (not gray) young stems, commonly rounded (not narrowly acute to acuminate) outer phyllary tips, and a single (not double) pappus without (vs. with) an inner row of a few deciduous pappus bristles. By its strongly coroniform pappus *Struchium* P. Br. is similar to the former three genera, but differs in many other features (see Table 1) and its affinities clearly are elsewhere.

Huberopappus, *Ekmania*, and *Gorceixia* form a tightly knit generic group that is somewhat removed from both New World and Old World coroniform genera, as well as the remaining genera of the Vernonieae. These three genera appear to be closest to *Pollalesta* HBK of the Piptocarphinae (as suggested by H. Robinson, pers. comm.), based on terminal capitula, type A pollen, angled young stems, leaf pubescence, and calcarate (not caudate) anther bases. However, *Pollalesta* (see Stutts, 1981) clearly differs from the former three genera by a generally double pappus with many free, rarely paleaceous or pseudocoroniform outer bristles. Nevertheless, it is perhaps best to stretch the boundaries of the Piptocarphinae (Vernoniinae sensu Jones, 1982) to include the former three genera.

The salient features that distinguish *Huberopappus* from other neotropical Vernonieae genera with a basally connate or annular pappus are summarized in Table 1, which includes the initial report of pollen types (see Keeley & Jones, 1979, for terminology) in the first five genera. The pollen types of *Pacourina* Aubl., *Rolandra* Rottb., and *Struchium* given in Stix (1960) and Robinson et al. (1980) are herein confirmed. Some of the information in Table 1 is from Aristeguieta (1964), Badillo (1989), and Baker (1873).

The last five genera in Table 1 tend to exhibit the combination of herbaceous to subshrubby habit, subterete stems, chartaceous often serrulate leaves, axillary sessile heads, aristate phyllaries, and lophate pollen and have been variously placed within the Vernonieae. Bentham (1873) and Baker (1873) referred *Heterocoma* DC., *Pacourina*, and *Struchium*

to the Sparganophoreae, whereas Robinson et al. (1980) placed them in the Vernoniinae. *Harleya* Blake, which was not positioned by Robinson et al. (1980), also seems to be best placed in the Vernoniinae. *Rolandra* has been placed in both the Lychnophoreae (Bentham, 1873; Baker, 1873) and the Rolandrinae (Robinson et al., 1980). Therefore, by the occurrence of coroniform taxa in each of these subtribes, it is apparent that pappus fusion, a derived vernonian condition (Keeley & Turner, 1990), has arisen independently in several different lineages.

Acknowledgments. I thank Otto Huber for setting aside his initial collections for my study during a visit in 1989 to Caracas and for use of his photograph in Figure 2; Bruno Manara for drawing Figure 1 and for correcting the Latin diagnosis; Harold Robinson for his determination of the pollen type of *Heterocoma;* and Victor Badillo, Rupert Barneby, Paul Berry, Charles Jeffrey, Sterling Keeley, and Harold Robinson for many helpful comments. My herbarium studies in Venezuela have been financially supported by the Missouri Botanical Garden, *Flora of the Venezuelan Guayana* project.

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Mosiera (Myrtaceae) in Mexico and Mesoamerica

Leslie R. Landrum
Department of Botany, Arizona State University, Tempe, Arizona 85283-1601, U.S.A.

ABSTRACT. The history and relationships of the mainly Caribbean genus *Mosiera* are discussed, and it is comprehensively described. Two Mexican and Mesoamerican species, *Psidium contrerasii* and *P. ehrenbergii*, are transferred to *Mosiera*.

Generic limits among the American Myrtinae (Myrtaceae) have long been obscure. Historically the greatest problem has been definition of the limits of *Psidium* L., a large, diverse, and poorly defined group to which many species of Myrtinae (e.g., *P. contrerasii* Lundell and *P. ehrenbergii* (Berg) Burret) have been assigned for want of a better place. Recently, Landrum & Sharp (1989) have described and illustrated seed coat characters that can be correlated with floral characters to separate *Psidium* from related genera, but the above two species are among a few that must be relocated. *Psidium contrerasii* and *P. ehrenbergii* are here assigned to *Mosiera*, a genus that mainly has been ignored since its description by Small (1933).

HISTORY OF *MOSIERA*

Small (1933) created *Mosiera* to contain two species from southern Florida that he had earlier (1913) recognized as belonging to *Anamomis* Griseb. (= *Myrcianthes* Berg). I agree with McVaugh (1973) that Small's original two species are best considered as one. Small assigned both *Anamomis* and *Mosiera* to the tribe Eugeniinae, where only the first genus belongs. Small recognized the species of *Mosiera* he had before him as being distinct from *Anamomis* because of characteristics of the fruit and inflorescence. Apparently unknown to him was the striking difference in embryo structure, the character of primary importance in differentiating subtribes of Myrteae.

Burret (1941), in his worldwide revision of *Myrtus* L. and segregate genera, considered *Mosiera* to be a synonym of *Myrtus*. Burret's concept of *Myrtus* included the Mediterranean type, *M. communis* L., a north African species, and a complex of Caribbean species, including the two that Small had originally placed in *Mosiera*.

McVaugh (1968) considered the Caribbean complex that Burret had placed in *Myrtus* to be more closely related to American genera (e.g., *Calycolpus* Berg) than *Myrtus*, but he did not then transfer them to *Mosiera* or any other American genus, considering that a more thorough knowledge was required before a final position could be assigned. Later (1973), he transferred the type species of *Mosiera* (*M. longipes* (Berg) Small) to *Psidium*.

In a posthumous publication, Bisse (1985) transferred several Cuban species of *Myrtus*, in the sense of Burret, and some species of *Psidium* to *Mosiera*. His inclusion of *Psidium guineense* Sw. in *Mosiera* leads me to believe that his concept of the genus was quite different from mine. I consider *Psidium guineense* to be a typical species of *Psidium* and, in fact, a close relative of *P. guajava* L., the type.

A revision of *Mosiera* is underway, but I believe that it is important that *Psidium contrerasii* and *P. ehrenbergii* be transferred now so that the correct names can be used in other publications and to bring attention to a genus until now unknown in Mexico and Central America. *Mosiera* is here for the first time critically compared to other genera and comprehensively described.

Mosiera Small, Man. S. E. Fl., 936. 1933. LECTOTYPE: *Mosiera longipes* (Berg) Small (= *Eugenia longipes* Berg) selected by McVaugh (1956).

Shrubs or trees to 15 m high. Hairs whitish, yellowish, or reddish brown, unicellular, simple, to ca. 0.5 mm long. Leaves persistent, coriaceous, the venation brochidodromous, with few to ca. 10 pairs of lateral veins that are united by a marginal vein that arcs between them near the leaf margin. Inflorescence a solitary axillary flower (infrequently a 3-flowered dichasium) or an axillary bracteate shoot with 1–3 decussate pairs of flowers. Flowers tetramerous; calyx lobes oblong to hemiorbicular, the calyx usually not fused or only slightly fused beyond the ovary's summit, tearing slightly or not at all between the lobes at anthesis; petals submembranous, white; bracteoles usually small, ovate-triangular, foliose in one species, caducous at about or before anthesis; stamens 60–200, folded toward the center in the bud; anthers globose, 0.3–0.7 mm long, usually with one terminal gland in the connective; ovary 2-locular; ovules 3–40 per locule, the placenta not prominent, the locules sometimes connected by an open-

ing. Fruit subglobose; seeds few, subreniform, the seed coat hard, lustrous, or in one species leathery and glandular, the external wall one to a few cells thick, the surface cells rounded to elongate, the central portion of the seed sometimes soft; embryo oily, whitish, C-shaped, the cotyledons reflexed or straight, less than ¼ the length of the embryo.

Relationship to *Eugenia* (Eugeniinae) and Other Genera of Myrtinae

Mosiera has been submerged in *Myrtus* and *Psidium* and is also probably closely related to *Calycolpus*. It is now clear that *Mosiera* is tetramerous while the others are all typically pentamerous, so there should be no confusion. On the other hand, *Mosiera* is superficially similar to *Chamguava* Landrum (Myrtinae) and *Eugenia* L. (Eugeniinae) and can easily be confused with either. Examination of embryos is the only certain way to distinguish these three genera. The synoptic key below summarizes the differences among all the above-mentioned genera.

1a. Embryo a solid mass, made up of the fused cotyledons, the hypocotyl usually not distinguishable; flowers tetramerous; inflorescence a solitary flower, or a bracteate shoot of 2 to a few decussate pairs of flowers ..... *Eugenia*

1b. Embryo at least half hypocotyl, the cotyledons distinguishable as erect or reflexed flaps at the apex; flowers tetramerous or pentamerous; inflorescence various.

2a. Seed coats membranous, thin, never verrucose; seeds to ca. 6–10 mm long; embryo starchy, the hypocotyl swollen, much wider than the cotyledons, a central core of vascular tissue clearly distinguishable from the surrounding cortex (in section); placenta often a protruding peltate structure; flowers tetramerous ..... *Chamguava*

2b. Seed coats hard, bony, or in *Mosiera ehrenbergii* leathery, verrucose; seed often less than 6 mm long; embryo oily, the hypocotyl not greatly swollen, about the same width as the cotyledons, a central core of vascular tissue not clearly distinguishable from the surrounding cortex; placenta protruding or not; flowers tetramerous or pentamerous.

3a. Flowers tetramerous; seed coat smooth, lustrous, or leathery-verrucose; cotyledons much shorter than the hypocotyl; anthers usually with a single terminal gland in the connective ..... *Mosiera*

3b. Flowers pentamerous; seed dull to rough (*Psidium*) or smooth, lustrous (*Calycolpus*, *Myrtus*); cotyledons about the same length as the hypocotyl (*Myrtus*), or much shorter (*Calycolpus*, *Psidium*); anthers with a few to several glands in the connective (occasionally with a single terminal gland in *Myrtus*).

4a. Seed coat dull or rough, not lustrous, covered with a thin layer of pulpy tissue when wet (or a glaze or crusty layer when dry), the hard portion of the seed coat (5–)8–30 cells thick at narrowest point; calyx tearing irregularly or between the lobes at anthesis; peduncles rarely in pairs on very short axillary shoots ..... *Psidium*

4b. Seed coat lustrous, smooth, not covered with a thin layer of pulpy or crusty tissue or a glaze, the hard portion of the seed coat 1–5 cells thick at narrowest point; calyx tearing between the lobes or not at all at anthesis; peduncles often in pairs on very short axillary bracteate shoots.

5a. Hypocotyl about equaling the cotyledons in length; calyx lobes triangular, unfused or scarcely fused beyond the summit of the ovary, without an apical appendage; anthers oblong, to ca. 1 mm long; ovary 2–3-locular; Mediterranean ..... *Myrtus*

5b. Hypocotyl much longer than the cotyledons; calyx lobes variously shaped, often fused well beyond the summit of the ovary, often with an elliptic or linear apical appendage; anthers oblong to linear, to ca. 2.5 mm long; ovary 2–6-locular; Central America and northern South America ..... *Calycolpus*

Mosiera contrerasii (Lundell) Landrum, comb. nov. Basionym: *Psidium contrerasii* Lundell, Wrightia 5(4): 84. 1975. TYPE: Guatemala. Petén: La Cumbre, in zapotal on top of hill, W of km 141–142 on the Petén–Izabal road, 12 Mar. 1975 (fl), *Lundell & Contreras 19085* (holotype, LL).

Tree 7–15 m high, glabrous or essentially so except for minute, obscure pubescence on youngest twigs and buds and on calyx lobes; hairs less than 0.3 mm long, whitish or reddish brown; young twigs light reddish brown or greenish, smooth, within about 1 year becoming gray to gray-tan, remaining smooth or becoming slightly flaky. Leaves ovate to lanceolate, 3–7.3 cm long, 1.2–2.5 cm wide, 2–3 times as long as wide, the margin slightly revolute when dry; apex bluntly acuminate; base rounded, cuneate, or acuminate, sometimes oblique; petiole channeled, 3–7 mm long, 0.5–1 mm thick; midvein impressed slightly above, prominent below; lateral veins about 7–10 straight pairs that extend from the midvein

to the marginal vein, alternating with weaker, branching veins that appear to arise in the marginal vein and extend back toward the midvein, sometimes impressed slightly above; blades subcoriaceous, drying gray-green to dark yellow-green, usually somewhat lustrous above, densely glandular. Peduncles uniflorous, 0.4–2 cm long, 0.5–1 mm wide, usually at leafless nodes, solitary or less often in pairs on short shoots; bracteoles caducous before anthesis, foliose, elliptic-linear, 4–6 mm long; calyx lobes ovate-oblong, ca. 2 mm long and wide, concave, pubescent within, glabrous proximally to pubescent distally without; petals suborbicular, ca. 4 mm long; hypanthium campanulate, 1.5–2 mm long; disk 1.5–2 mm across; stamens 60–70, to ca. 4 mm long; anthers ca. 0.3 mm long; style ca. 4 mm long; ovary 2-locular; ovules 7–11 per locule, biseriate, the placenta central; fruit globose, ca. 8 mm wide; seeds 4–10 per fruit, subreniform, ca. 4 mm long, lustrous light yellow.

Phenology. Flowering from March to June; fruit maturing May to September.

Habitat. As far as is known, growing in seasonally dry, partially deciduous tropical forest on limestone.

Additional specimens examined. GUATEMALA. PETÉN: La Cumbre, zapotal, W of km 141–142 of Petén–Izabal road, on top of hill, 12 Mar. 1975 (young fr), *Lundell & Contreras 19086, 19089*, 10 May 1975 (fr) *19278*, 11 Sep. 1975 (fr), *19847* (all LL). MEXICO. QUINTANA ROO: km 33 del camino Carrillo Puerto–Vigía Chico, 29 July 1983 (fr), *Durán & Olmsted 381* (MO); 1 km al S del camino que nace 8 km al W de Vigía Chico, 5 Aug. 1983 (fr), *Durán et al. 400* (MO); Carrillo Puerto, Sianka'an, 14 km al SE del crucero de Chumpon, 7 June 1984 (fl), *Durán & Sánchez 990* (MEXU).

Mosiera ehrenbergii (Berg) Landrum, comb. nov.

Basionym: *Myrtus ehrenbergii* Berg, Linnaea 27: 404. 1856. *Psidium ehrenbergii* (Berg) Burret, Notizbl. Bot. Gart. Berlin-Dahlem 15: 483. 1941. TYPE: Mexico. *Ehrenberg 1039* (holotype, B destroyed).

Shrub or small tree 0.5–4 m high, smooth or scaly barked; hairs whitish, erect to antrorse, ca. 0.1 mm long, essentially confined to young twigs and margins of petals and calyx lobes; young twigs reddish brown to gray-brown, densely to sparsely covered with hairs, these persisting until the first bark falls, the older twigs smooth or the bark becoming rough and flaky. Leaves elliptic, oblong, or elliptic-lanceolate, 0.9–3 cm long, 0.4–1 cm wide, 1.8–4 times as long as wide, glabrous, the margin often slightly revolute; apex obtuse or emarginate; base acute; petiole 1–2 mm long, ca. 0.5 mm thick; midvein flat or slightly raised above, prominent below; lateral veins 2–7 pairs, weak, a marginal vein usually not detectable; blades subcoriaceous, usually drying gray-green, nearly concolorous, densely glandular. Peduncles uniflorous, 3–15 mm long, ca. 0.7 mm wide, flattened, solitary or more often in pairs, one opposite the other on short, leafless axillary shoots; bracteoles oblong-linear, 1–2.5 mm long, usually caducous before anthesis; calyx lobes ovate to hemiorbicular, 1.5–2 mm long and wide, glabrous or with a ciliate margin, glandular, often tinged with purple; petals suborbicular, ca. 3.5 mm long, often tinged with purple; hypanthium campanulate, 2–3 mm long, tearing slightly between the calyx lobes; disk 2–5 mm across, the staminal ring sparsely pubescent; stamens 90–130, 3–4 mm long; anthers 0.5–0.7 mm long; style 3–6 mm long; ovary 2-locular; ovules 3–11 per locule, biseriate or multiseriate; fruit subglobose, turning dark purple-black at maturity, 6–10 mm wide; seeds 1–5 per fruit, ca. 4 mm long, the seed coat not operculate, leathery, 0.1–0.2 mm thick, strongly glandular.

Phenology. Flowering mainly from May to September; fruiting mainly from August to October.

Habitat. Found growing in subtropical, seasonally deciduous scrub forest and in desert.

No type specimen has been found for *Myrtus ehrenbergii*, but the protologue leaves little doubt about the identity of the species. Isotypes may exist and should be searched for in European herbaria.

Representative specimens examined. MEXICO. HIDALGO: Cardonal, Cerro Boludo de Tolantango, 42 km al NE de Ixmiquilpan, 31 Aug. 1976 (fr), *González Medrano 9623* (MEXU). SAN LUIS POTOSÍ: 2 km E of El Abra on road from Ciudad Valles to Tampico, 130 m, 27 Oct. 1985 (st), *Bartholomew, Landrum et al. 3502* (ASU, CAS); 4 km E of Charco Blanco on road to Guadalcázar, 1,600 m, 28 Oct. 1985 (fr), *Bartholomew, Landrum et al. 3568* (ASU, CAS); San José Pass, 10 Oct. 1890 (fr), *Pringle 3524* (A, GH); Minas de San Rafael, May 1911 (fl), *Purpus 5211* (F, GH, MEXU, MICH, MO, NY, UC); 4 km al W de Lagunillas, 900 m, 29 Apr. 1965 (fl), *Rzedowski 7608* (MICH). TAMAULIPAS: 18 km al SO de Miquihuana, 1,700 m, 15 Aug. 1972 (fr), *González Medrano 4723* (MEXU); 6 km al E del Sauz, al NE de Tula, después de Francisco Medrano, 1,600 m, 7 Dec. 1976 (fr), *González Medrano 10117* (MEXU); Tula, 3 km al W del Capulín, 2,000 m, Oct. 1976 (fr), *González Medrano 10106* (MEXU); 2 km al N de la Verdolaga, cerca de Las Antonias, 12 Aug. 1972 (fr), *González Medrano et al. 4558* (MEXU, MO); 2 km al SE de Magdaleno Aguilar, 1,600–1,800 m, 20 Sep. 1976 (fr), *González Medrano et al. 9888* (MICH); Tula, 5 km al W del Ejido El Saltillo, 1,500 m, 3 July 1985 (young fr), *Hiriart 758* (MEXU); 18 km SE of Bustamante toward Presita and Tula (99°40′W, 23°21′N), 1,700 m, 20 May 1973 (fl), *Johnston et al. 11161* (ASU, CAS, MEXU, NY); 6 mi. SW of Palmillas (23°18′N, 99°39′W), 5,300 ft., 1 Aug. 1976 (fl), *Webster & Armbruster 20508* (MEXU).

Placement of *Myrtus ehrenbergii* in any genus is somewhat difficult because of its unusual seed coat, which is leathery, not operculate, and strongly glandular. The only other species of Myrtinae known to me with similar seed coats belong to the Australasian genus *Pilidiostigma*, which has a very different embryo similar to that of *Chamguava*.

McVaugh (1968) first suggested that *Myrtus ehrenbergii* was related to the complex of Caribbean species Burret referred to *Myrtus*, and that I consider to be *Mosiera*. It shares with them 4-merous flowers, oil-storing embryos with the cotyledons much shorter than the hypocotyl, ovaries with nonprotruding placentae, and inflorescences of solitary flowers or abbreviated bracteate shoots. The locules are often incompletely closed as they usually are in the ca. 10 additional species of *Mosiera*.

Another reason for believing *Myrtus ehrenbergii* belongs to *Mosiera* is its geographic position. The only other genera of Myrtinae that are geographically close are *Pimenta* and *Psidium*, both of which are dissimilar in many ways.

Mosiera ehrenbergii differs from the other species of *Mosiera* most notably in the structure of the seed coat. Similar situations exist in *Acca* and *Pimenta*, both of which have single species with unusual seed coats (*A. sellowiana* (Berg) Burret; *P. pseudocaryophyllus* (Gomes) Landrum) (Landrum, 1986).

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Three New Species and a New Combination in the Asclepiadaceae from the Venezuelan Guayana

Gilberto Morillo
Fundación Instituto Botánico de Venezuela, Apartado 2156, Caracas 1010-A, Venezuela

ABSTRACT. In preparation of the Asclepiadaceae treatment for the *Flora of the Venezuela Guayana*, one new species of *Matelea*, *M. stergiosii*, and two new species of *Ditassa*, *D. ottohuberi* and *D. verticillata*, are herein described. A new combination is also made in *Ditassa*, *D. bolivarensis*.

Matelea stergiosii Morillo, sp. nov. TYPE: Venezuela. Estado Bolívar: moist forest on rocky slopes, near Campamento Auraima, Río Paragua, 6°22′30″N, 63°33′30″W, 330 m, May–June 1987, *Stergios 10450* (holotype, VEN; isotypes, MO, MY, NY, PORT). Figure 1.

Species haec *Matelea squiresii* (Rusby) Morillo proxima, sed recedit: foliis late ovato-ellipticis vel obovato-ellipticis, corolla 7.8–10 mm diametro, corollae lobis, 3–3.4 mm longis, 2.4–3.2 mm latis, intus breviter et dense puberulentis, gynostegio, 1.6–1.65 mm alto, 2.3–2.6 mm diametro (0.95–1.2 mm alto et 1.55–1.95 mm diametro in *M. squiresii*); antheris 1.4 mm latis; coronae segmentis basi 1.2–1.25 mm latis.

Twining vine; stems with short and inconspicuous pubescence in two rows; leaves opposite; petioles 0.5–1.3 cm long, puberulent, blades broadly ovate-elliptic to obovate-elliptic, 3–5.5 × 1.2–3.3 cm, apex usually ± abruptly acuminate, base obtuse to cuneate, glabrous except for a few hairs along the midvein above, 5 or 6 pairs of lateral veins, 4 nectaries at the base. Inflorescence subaxillary, 2- or 3-flowered; peduncle 1–2 mm long, bracts ovate, 0.6–0.7 mm long, ciliate along the margins; pedicels 2–2.5 mm long, glabrous. Calyx lobes ovate-elliptic, 1.8–2 × 1.1–1.3 mm, with few short, curved hairs outside and short cilia along the margins, the apex narrowly obtuse. Corolla rotate, 7.8–10 mm diam., the lobes 3–3.4 × 2.4–3.2 mm, apparently green and brown, densely short-appressed or erect-puberulent inside, with few short, curved hairs along a medial line outside, the apex obtuse. Gynostegium shortly stipitate, 1.6–1.65 mm long (tall) and 2.3–2.6 mm diam.; anthers horizontal, 1.3–1.4 mm wide. Pollinia horizontal, irregularly and narrowly ovate-truncate, 0.45 × 0.3 mm, caudicles 0.2–0.25 mm long, corpusculum narrowly sagittate, 0.2 × 0.1–0.12 mm. Corona formed by 5 column-shaped segments, which are basally expanded, the basal part 1.2–1.25 mm wide, margin almost entire. Fruits unknown.

This species belongs to a difficult complex with *Matelea squiresii*, which is known from southern Venezuela and the Guianas (also probably in Brazil) from lowland moist forests. *Matelea stergiosii* differs clearly in the somewhat wider leaf blades, much wider corolla, and gynostegium and inner face of the corolla lobes with denser pubescence.

Ditassa ottohuberi Morillo, sp. nov. TYPE: Venezuela. Territorio Federal Amazonas: summit of Cerro Coro-Coro, NW headwaters of Río Manapiare, NW section of Serranía de Yutajé, 5°46′N, 66°12′W, 2,200 m, Nov. 1987, *Huber 12290* (holotype, VEN; isotypes, MO, MY, NY, RB, TFAV).

Species nostra *Ditassae acerifoliae* Lasser et Maguire affinis, sed differt: corolla subcampanulata, 1.9–2 mm diametro, lobis 1.3–1.4 × 0.8–0.9 mm; gynostegio breviter stipitato 0.6–0.65 mm longo; antherae alis 0.26–0.32 mm longis, corona exteriori segmentis oblongis vel anguste triangulari-oblongis, 0.65–0.75 × 0.2 mm, corona interiori segmentis 0.2 mm longis.

Erect suffruticose plant, 20–30 cm high; stems shortly branched, branches rugose, the lower part with conspicuous persistent petiole bases, internodes 0.5–1 mm long, minutely erect-puberulent. Leaves apparently disjunctly verticillate or subspirally arranged, erect, up to 8 per whorl; petioles 0.6–1.8 mm long, decurrent, glabrous; blades fleshy, ± linear, roundly triquetrous in cross section, 0.8–1 × 0.05–0.07 cm, the apex mucronate, the base gradually cuneate, the surface glabrous, veins and nectaries not evident. Inflorescences axillary or interpetiolar, cymose, 1–3-flowered; peduncles 0.6–1.6 mm long, glabrous, bracts and bracteoles narrowly ovate, 0.6–1 mm long, glabrous; pedicels 2.5–2.6 mm long, glabrous. Calyx lobes narrowly ovate, 1.1–1.5 × 0.45–0.55 mm, obtuse. Corolla subcampanulate, 1.9–2 mm diam., the tube 0.5–0.6 mm long, glabrous, the lobes obliquely ovate, somewhat concave, suberect in anthesis, 1.3–1.4 × 0.8–0.9 mm, glabrous outside, puberulent-papillose inside, the apex narrowly obtuse. Gynostegium shortly stipitate, 0.6–

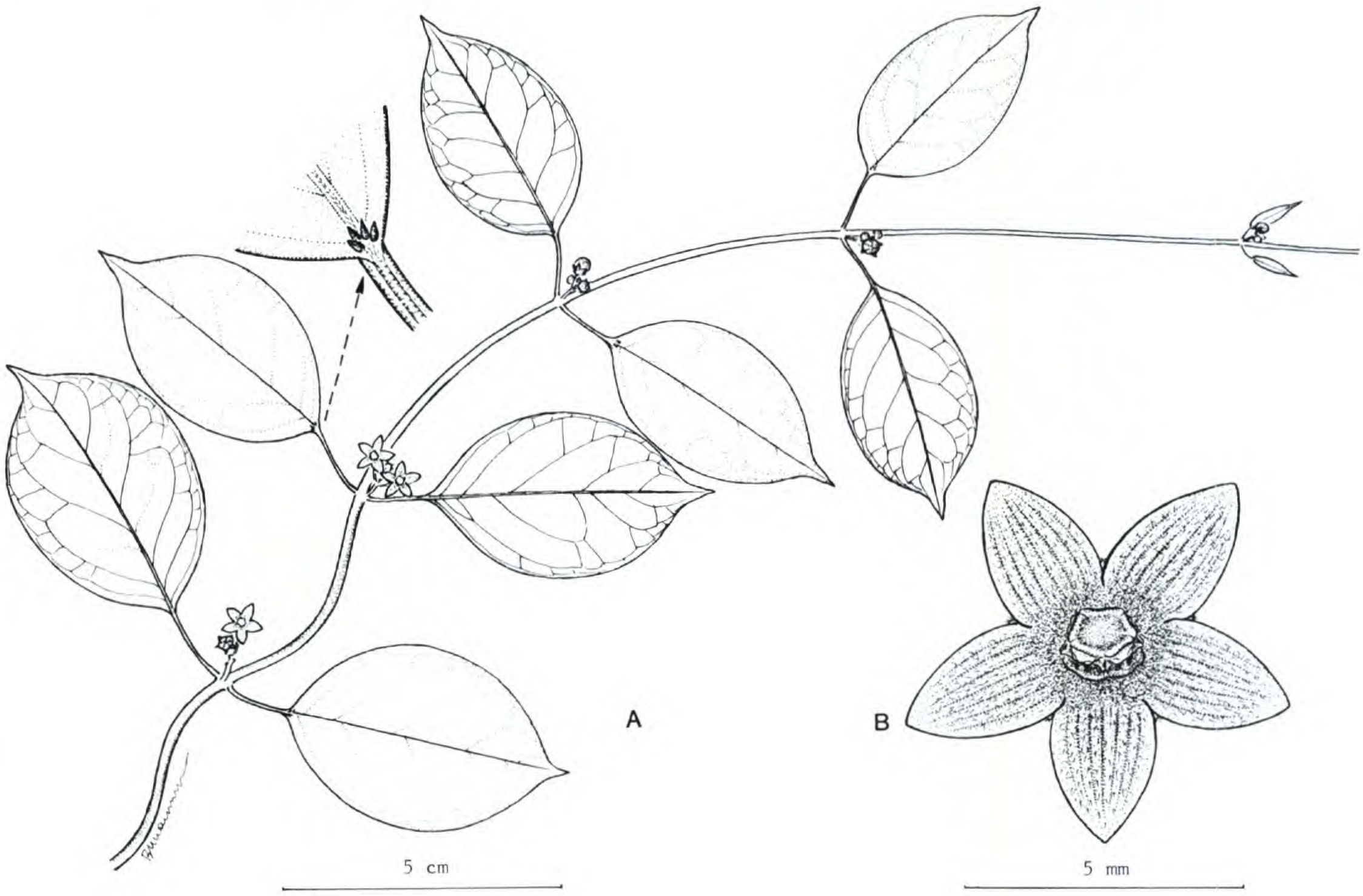

Figure 1. *Matelea stergiosii.* —A. Habit, with detail of glands at base of leaf blade. —B. Detail of flower.

0.65 mm long (tall), 0.7–0.8 mm diam., stipe 0.1–0.15 mm long; anther wings 0.26–0.32 mm long. Pollinia pendulous, narrowly ovate, 0.25–0.26 × 0.06 mm, caudicles curved, 0.05 mm long, corpusculum oblong-obovoid, 0.4 × 0.06 mm. Corona double, outer segments narrowly triangular, 0.7–0.75 mm long × 0.2 mm wide at base, slightly longer than gynostegium, united by a short ring of tissue, inner segments scalelike, irregularly ovate, 0.2 mm long. Fruits erect, narrowly ovate-fusiform, 2.9–3.2 × 0.3–0.4 cm, long-attenuate, glabrous, with persistent calyx; seeds oblong ovate, 4–4.5 × 1.2–1.5 mm, brown-orange, margins entire, coma ca. 20 mm long.

The general aspect of this plant is nearly identical to that of *Ditassa acerifolia* Lasser & Maguire, a species endemic to Cerro Yaví, but the new species differs by the characters included in the diagnosis. These two related species of *Ditassa* are distinguished from the other Guayanan and Guianan species of the genus in possessing erect, woody stems and dense acicular, spirally arranged leaves.

Ditassa verticillata Morillo, sp. nov. TYPE: Venezuela. Territorio Federal Amazonas: Serranía Yutajé, Cerro Yutajé, occasional on rocky slopes, middle section of main branch, lefthand fork of Caño Yutajé, 1,300–1,400 m, Feb. 1953, *Maguire & Maguire 35243* (holotype, VEN; isotype, NY).

Species nostra *Ditassae taxifoliae* Decne. proxima sed notabilis: foliis verticillatis, coronae interioris lobis linearioblongis, 0.9–0.95 mm longis; corollae lobis intus basi pilis erectis instructis.

Suffruticose plant, stems mostly erect, sometimes slightly twining, 30–55 cm long, shortly and densely puberulent throughout. Leaves 3- or 4-verticillate, rarely opposite in the upper nodes; petioles 0.2–0.3 cm long, with few hairs at the apex and margins; blades linear, 1.5–2.1 × 0.1–0.3 cm, coriaceous, the apex acute to mucronate, the base shortly cuneate, midvein prominent below, secondary veins not evident, surface glabrous throughout, margins slightly to strongly revolute; nectaries absent. Inflorescence subaxillary cymes, 1- or 2-flowered; peduncle 0.7–1.1 mm long, thick and rugose, rachis bracteate, 0.1–2 mm long, bracts ovate to deltoid, 0.5–0.7 mm long, pedicels 1.7–2 mm long, glabrous. Calyx lobes ovate, 0.9–1.1 × 0.7–0.8 mm, obtuse, glabrous, eciliate. Corolla campanulate, the tube 0.8–0.9 mm long, glabrous, the lobes ovate, 1.7–1.8 × 1.2–1.3 mm, glabrous outside, with short, appressed hairs in the upper ⅔ and short, erect hairs in the lower ⅓ inside, the apex narrowly

obtuse. Gynostegium sessile, 1.1–1.2 mm long (tall), 0.9–1 mm diam., anther wings 0.8 mm long. Pollinia narrowly ovoid-ellipsoid, 0.3 × 0.09–0.1 mm, caudicles 0.09 mm long, corpusculum narrowly elliptic or narrowly ovate, 0.23 × 0.09 mm. Corona double, outer segments rhombic-ovate and long-acuminate, 1.75 mm long, 0.7 mm wide at base, united with each other in the lower 0.3 mm, inner segments linear to oblong, 0.9–0.95 mm long, curved above the anthers. Fruits unknown.

Ditassa verticillata is closely related to *D. taxifolia*, with which it was originally confused, but differs in the mostly 3- or 4-verticillate leaves, peduncles to 1.1 mm long, corolla lobes with erect trichomes in the lower, inner half, and internal segments of corona linear-oblong and longer than the anther membranes.

Ditassa bolivarensis (R. Holm) Morillo, comb. nov. *Cynanchum bolivarense* R. Holm, Fieldiana, Bot. 28: 504. 1953. TYPE: Venezuela. Bolívar: in woods bordering streams draining into Río Kukenán, base of Mount Roraima, 1,185–1,280 m, *Steyermark 58555* (holotype, F; isotype, VEN).

Transfer of *Crinum nerinoides* to *Ammocharis* (Amaryllidaceae)

David J. Lehmiller
Doctors' Building, Suite 316, 3155 Stagg Drive, Beaumont, Texas 77701, U.S.A.

ABSTRACT. Lack of field observations previously hampered taxonomic discussions of *Crinum nerinoides*. Several investigators suggested that this plant might be *Ammocharis* rather than *Crinum;* however, definitive reclassification was impossible because pressed specimens often provide inadequate material to differentiate between the two genera. During a Namibian expedition in 1991, this taxon was observed in flower and in fruit; the morphological features were specific for *Ammocharis*.

Baker (1903) worked from a single incomplete specimen when he described *Crinum nerinoides* Baker. The pressed specimen originated in Namibia (formerly South West Africa) 11 years prior to Baker's account and consisted only of a scape bearing an umbel of seven flowers; no drawings or descriptive field notes accompanied the specimen.

After Milne-Redhead and Schweickerdt examined the type specimen, they attached a determinant slip annotated with "probable *Ammocharis coranica*." However, in revising the genus *Ammocharis*, Milne-Redhead and Schweickerdt (1939) made the following statement about *C. nerinoides:* "This is most probably an *Ammocharis*, but the type material is too incomplete to be placed with certainty." Sölch (1969) discussed *C. nerinoides* under the heading "dubious species" of *Ammocharis*, but he also concluded that the type material was too incomplete to be classified generically.

Verdoorn (1973) recognized *Crinum nerinoides* in her revision of the southern African species and cited two new herbarium collections of the species, both also from Namibia. Roessler (1974) followed Verdoorn's treatment in his review of Namibian *Crinum*. The paucity of herbarium materials led Roessler to remark that *C. nerinoides* was rare. Duncan (1982) cultivated and propagated bulbs of *C. nerinoides* collected in Namibia; these were illustrated by several artists, most recently Brodley (Plessis & Duncan, 1989).

Ammocharis and *Crinum* are closely related genera and can be confused in herbarium mounts. The outstanding morphological feature that separates these genera is the leaf arrangement: distichous and biflabellately arranged in *Ammocharis;* rosulate or distichous but never biflabellately arranged in *Crinum*. Leaves are sheathed at the base in *Crinum* but not in *Ammocharis*. Unfortunately, the investigators who dealt with *C. nerinoides* were unaware of its leaf arrangement, a character best seen in the field.

During a Namibian expedition in January–February 1991, D. Hardy of the National Research Institute (PRE) and I came upon a huge colony of *C. nerinoides* growing in a pasture at Farm Okaseko in the Gobabis District; these bulbs carpeted an area approximately 200 × 20 m (estimated number in excess of 20,000). By chance, about 25 bulbs were blooming late, since this species ordinarily blooms in December after the onset of the rainy season. All of the plants had well-developed foliage because local rainfall had been unusually abundant. The leaves were clearly distichous and biflabellately arranged (Fig. 1A), and sheathing of leaves was absent at the base; the plant was an *Ammocharis*, not a *Crinum*. Also, the fruiting bodies were partitioned by three shallow furrows in the pericarp, differing from fruiting bodies of *Crinum*, which lacked furrows (Herbert, 1837). We found a second cluster of blooming bulbs surrounding a limestone pan near the town of Aminuis (Fig. 1B).

Ammocharis nerinoides (Baker) Lehmiller, comb. nov. Basionym: *Crinum nerinoides* Baker, Bull. Herb. Boissier ser. 2, 3: 666. 1903. TYPE: Namibia. Gobabis District: Hereroland, 1892, *Dove s.n.* (holotype, Z).

Bulb ovoid, covered with a brown papery tunic, 20–51 mm diam., tapering into a neck 50–85 mm long. Leaves 4–10, distichous and biflabellately arranged, arching or sprawling on the ground, linear, mildly channeled, minutely serrated on the margins, green, all but new leaves growing out with truncated ends, 130–380 mm long and 3–10 mm wide. Scape compressed, reddish green, 40–115 mm long. Spathe valves papery at anthesis. Umbel 1–7-flowered; flowers actinomorphic, scented. Pedicels 8–19 mm long. Ovary a small swelling 3–5 mm long and 3–4 mm wide. Perigone tube not curved, red, 13–20 mm long. Perigone segments lanceolate, distally recurved, pink with a broad dull red stripe on the dorsal keel, unequal with the inner narrower, 43–

Figure 1. *Ammocharis nerinoides* (Baker) Lehmiller. —A. Distichous leaves, biflabellately arranged. Namibia, Gobabis District, Farm Okaseko, 31 January 1991. —B. Blooming bulb. Namibia, Gobabis District, Hereroland East #2, 2 km north of Aminuis, 1 February 1991.

47 mm long and 8–11 mm wide. Filaments pink, unequal with the inner longer, 38–41 mm long; anthers white, turning dark tan and becoming curved at maturity, 3 mm long; pollen gray. Style pink, 37–45 mm long, with a tiny capitate stigma. Fruit subglobose, marked with three furrows and appearing trilobulated, often with a short apical beak to 5 mm long, reddish brown, 18–20 mm diam., indehiscent; seeds 3–12 per fruit, ovoid or angled by pressure to resemble parts of a sphere, smooth, light green, to 12 mm diam.

Habitat. Arid ecology with an erratic, summer rainy season. Open grasslands in low places or near limestone pans; clayish calcareous soils. Flowering induced by summer rains.

Additional specimens examined. NAMIBIA. GOBABIS DISTRICT: Farm Nico, 1958, *Merxmüller & Giess 1176*

(PRE); Farm Eskadron, 1969, *Mason & Boshoff 2516* (PRE); Farm Combumbi, 1977, *Giess 14919* (WIND); Farm Okaseko, 1991, *Hardy 7231* (PRE); Hereroland East #2, 2 km N of Aminuis, 1991, *Hardy 7235* (PRE). ETOSHAPAN: Adamax, 1974, *le Roux 596* (PRE); same locality, 1975, *Müller 196* (WIND).

Ammocharis coranica (Ker-Gawl.) Herb., which is epidemic in Namibia, is a huge bulb in comparison to *A. nerinoides* and is easily distinguished among herbarium mounts on the basis of bulb diameter, leaf width, scape dimensions, and umbel size; the floral parts are remarkably similar. In the field, the many-flowered bright-red umbels and wide leaves of *A. coranica* could never be confused with the diminutive, few-flowered pink umbels and narrow leaves of *A. nerinoides*. The specific epithet "nerinoides" is most appropriate since, when casually observed, *A. nerinoides* resembles a species of *Nerine*.

While in Windhoek I visited W. Giess, who was curator of the Namibian Herbarium (WIND) for 40 years and is now retired. During the interview Giess kindly projected 35-mm color slides recording *A. nerinoides* in bloom at Farm Nico and Farm Combumbi (see list of specimens examined). Giess also permitted me to examine field-collected bulbs, which he cultivated in his garden; these too exhibited biflabellately arranged, distichous leaves.

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Two New Species of *Aristida* (Poaceae) from Brazil

Hilda Maria Longhi-Wagner
Departamento de Botânica UFRGS–Av. Paulo Gama, s.n.–90049 Porto Alegre, Rio Grande do Sul, Brazil

ABSTRACT. Two new species of the "Ripariae" group of *Aristida* are described and illustrated: *A. brasiliensis* is distinguished by the lower glume, which is shorter than the upper one, and by the pubescent collar; *A. constricta* by the articulation at the base of the long column of the lemma. A key to the group is provided.

The genus *Aristida* L. comprises about 280 species from tropical and subtropical areas. During the revision of this genus for Brazil, two new species were found and are described in this paper. Specimens of both species had been previously identified as different species by earlier authors and can be included in the "Ripariae" group discussed by Henrard (1928, 1932). According to Henrard, this group includes *A. riparia* Trin. & Rupr., *A. megapotamica* Sprengel, *A. oligospira* Trin., and *A. trinii* Henrard, and is characterized by the spikelike panicles and the lower glume longer than the upper one. Actually, *A. trinii* does not belong to this group due to its linear and subdense, rather than spikelike, panicle and shorter spikelets. On the other hand, the inclusion of *A. brasiliensis* in this group, based on its habit and spikelike panicle, enlarges the circumscription of the "Ripariae" because *A. brasiliensis* has the lower glume shorter than the upper one. These species can be distinguished by the following characteristics.

KEY TO THE TAXA OF *ARISTIDA* GROUP RIPARIAE

1a. Callus of the lemma obtuse ..... *A. oligospira*
1b. Callus of the lemma acute or bifid.
  2a. Lower glume shorter than the upper one; collar pubescent ..... *A. brasiliensis*
  2b. Lower glume longer than the upper one; collar glabrous.
    3a. Callus of the lemma bifid .... *A. riparia*
    3b. Callus of the lemma acute.
      4a. Lemma articulated at the base of the 10–15-mm-long column ... . *A. constricta*
      4b. Lemma not articulated; column 29–60 mm long.
        5a. Awns of the lemma contorted at the base .... *A. megapotamica* var. *megapotamica*
        5b. Awns of the lemma straight at the base .. *A. megapotamica* var. *brevipes*

Aristida brasiliensis Longhi-Wagner, sp. nov. TYPE: Brazil. Minas Gerais: ca. 12 km from Barão de Cocais, base of Serra do Caraça, 28 Jan. 1971, *H. S. Irwin et al. 29325* (holotype, SP; isotypes, MO, NY, UB). Figure 1.

Perennis, 65–120 cm alta. Laminae supra glabrae saepe pilis sparsis longis ad basin praedictae, 25–50 cm longae, 0.25–0.35 cm latae, culmorum inferne planae, recurvatae, superne convolutae; ligula ciliata, ca. 0.2 mm longa; collum pubescens. Panicula spiciformis, densa, 16–23 cm longa. Glumae uninervatae, scabrae, inferiores 15.5–20 mm longae (aristae 5–8 mm longae computatae), superiores 23.5–28 mm longae (aristae 7–10 mm longae computatae). Lemma 33–39 mm longum (callo et columna computatis), columna 23–29 mm longa, callo acuto, 1 mm longo; aristae rectae, centralis 47–59 mm longa, laterales 40–53 mm longae.

Perennial, caespitose, 65–120 cm tall. Sheaths longer than the internodes, glabrous, sparsely long bearded at the summit especially in the innovations, with deciduous hairs to 2 mm long, collar pubescent; ligule ciliate, ca. 0.2 mm long; blade 25–50 cm long, 0.25–0.35 cm wide, abaxially scabrous, glabrous or sparsely hairy near the base (hairs ca. 2 mm long), flat and recurved at the base, convolute upward. Panicle dense and spikelike, 16–23 cm long, 3–6 cm wide (including the awns), erect. Glumes lanceolate, acuminate, awned, 1-nerved, the lower 15.5–20 mm long (including the 5–8-mm-long awns), 0.5–0.8 mm wide (lateral view), densely scabrous, the upper ones 23.5–28 mm long (including the 7–10-mm-long awns), 0.5–0.7 mm wide, minutely scabrous. Lemma cylindrical, smooth, 33–39 mm long (including the twisted 23–29-mm-long column and the acute and hairy 1-mm-long callus); awns straight, the central one 47–59 mm long, the lateral ones 40–53 mm. Palea hyaline, 2 mm long, 0.5 mm wide, acute, 2-nerved. Lodicules 2, hyaline, 1.5 mm long, 0.3 mm wide. Stamens 3. Caryopsis 5.5 mm long, 0.6 mm wide.

Distribution and ecology. Brazil, from Minas Gerais to Santa Catarina. It is most common in campo rupestre and cerrado vegetation, up to 1,400 m.

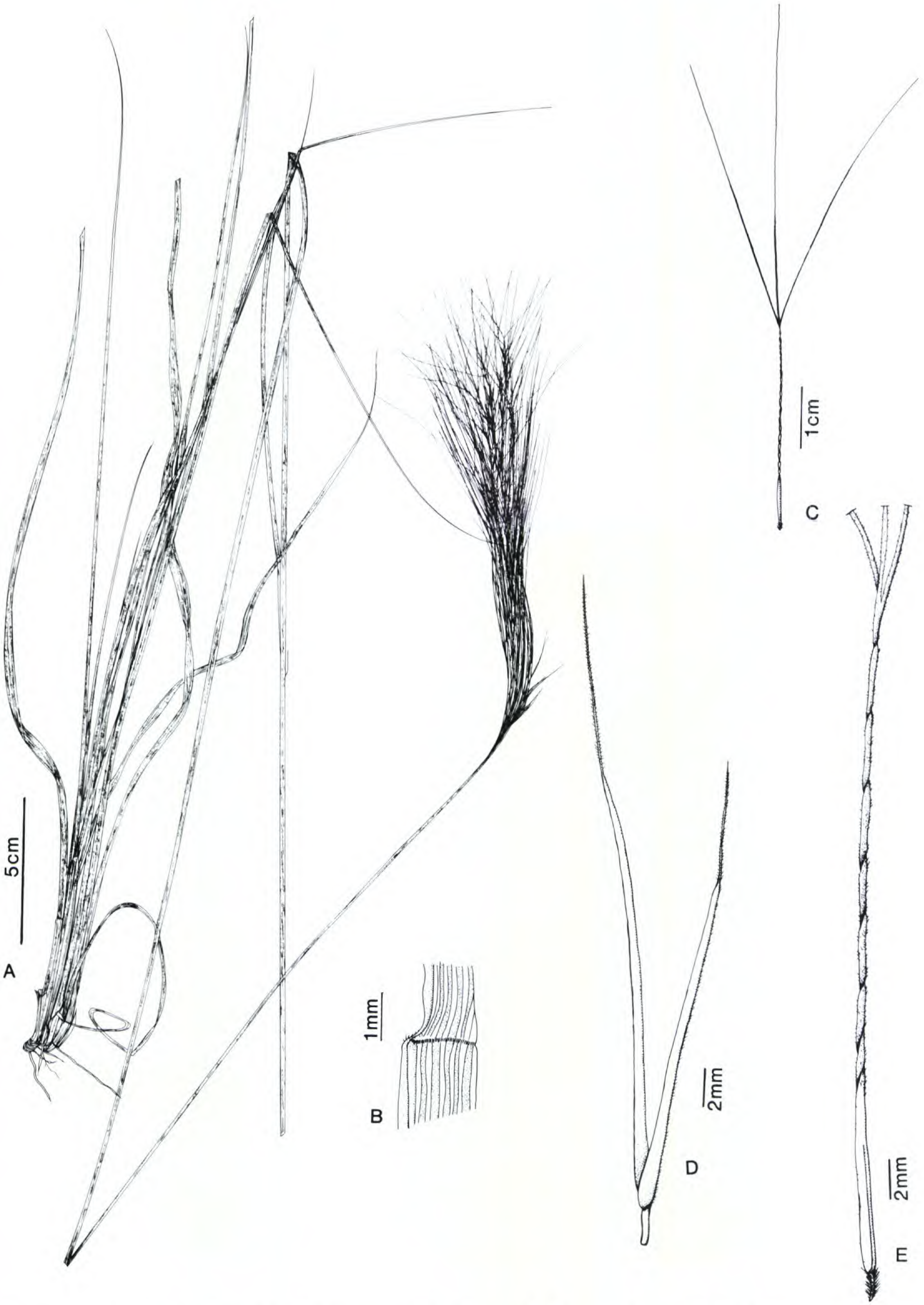

Figure 1. *Aristida brasiliensis* Longhi-Wagner. —A. Habit. —B. Pubescent collar. —C. Anthecium. —D. Glumes, lateral view. —E. Lemma, awns partially removed. (*Irwin et al. 28819.*)

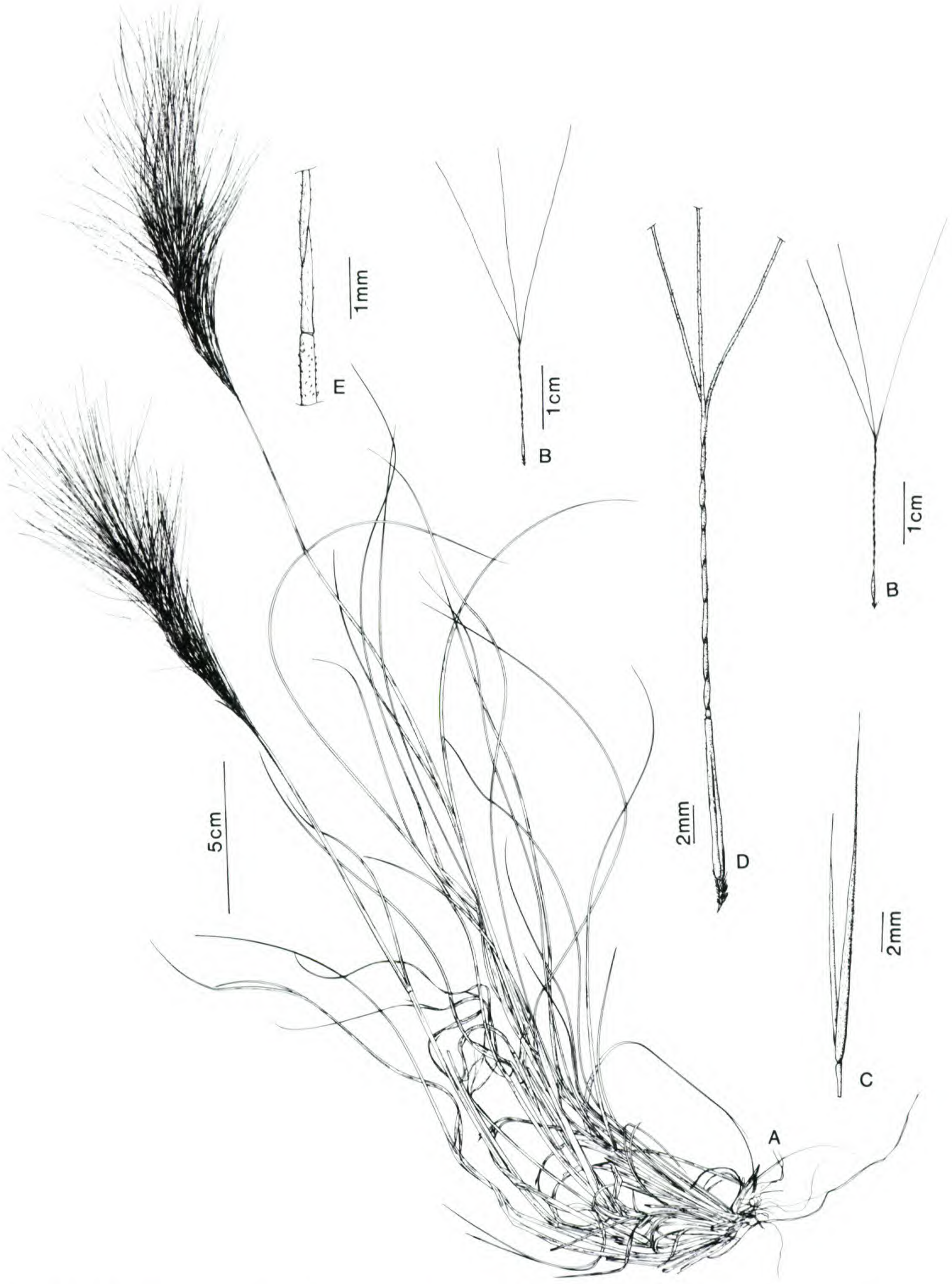

Figure 2. *Aristida constricta* Longhi-Wagner. —A. Habit. —B. Anthecia. —C. Glumes, lateral view. —D. Lemma, awns partially removed. —E. Lemma apex with an articulation. (*Longhi-Wagner et al. 1562.*)

Paratypes. BRAZIL. MINAS GERAIS: ca. 10 km W of Barão de Cocais, 22 Jan. 1971, *H. S. Irwin et al. 28819* (UB); Diamantina, 8 km E Diamantina, road to Extração, 16 Mar. 1970, *H. S. Irwin et al. 27687* (MO, NY, UB), km 996–997.5 antiga ferrovia Diamantina–Corinto, 12 Feb. 1982, *A. G. Burman & T. Sendulsky 767* (SP), Serra de San Antonio, 27–30 Dec. 1929, *Chase 10395* (MO, US); Santa Barbara, Serra do Caraça, 22 Jan. 1972, *A. Macedo 5230* (HB, MBM, MO). SÃO PAULO: campos de Bocaina, 6 Apr. 1894, *A. Loefgren 2364* (SP). SANTA CATARINA: Lages, Morro do Pinheiro Seco, 19 Feb. 1971, *L. B. Smith & Klein 15926* (HBR).

Aristida brasiliensis is closely related to *A. megapotamica* var. *brevipes* Henrard from Brazil, sharing a similar habit and panicle morphology, but can be distinguished by the characteristics cited in the key. In addition, *A. megapotamica* var. *brevipes* has a longer column (29–49 mm long) and callus (1.2–2 mm long). It is also closely related to *A. spiciformis* Ell., from North America. They are similar in habit, panicle, and relative length of the glumes. However, *A. spiciformis* differs in its characteristic glumes, which are shorter and abruptly long awned, spreading awns of the lemma, longer callus (1.5–2 mm long), and the absence of a pubescent collar. Henrard (1933) cited *Chase 10395* as a paratype of *A. megapotamica* var. *brevipes*. It is possible that Henrard did not notice the differences in the length of the glumes and the pubescent collar. The cited collection agrees perfectly with the new species described here.

Most of the paratypes now identified as *A. brasiliensis* were previously referred to *A. implexa* Trin., which is a synonym of *A. megapotamica*.

Aristida constricta Longhi-Wagner, sp. nov. TYPE: Brazil. Rio Grande do Sul: Santana do Livramento, Cerro Palomas, 17 Nov. 1987, *Longhi-Wagner et al. 562* (holotype, ICN; isotype, MO). Figure 2.

Perennis, 24–46 cm alta. Laminae glabrae, 10–33 cm longae, 0.2–0.35 cm latae, culmorum inferne planae, recurvatae, superne convolutae; ligula ciliata, ca. 0.2 mm longa; collum glabrum. Panicula spiciformis, densa, 10–15 cm longa. Glumae uninervatae, inferiores 16–19.5 mm longae (aristae 4–6 mm longae computatae), scabrae, superiores 13–15 mm longae (aristae 2–2.5 mm longae computatae), laeves. Lemma 18–22 mm longum (callo et columna computatis), in basi columna constrictum, articulatum; columna 10–15 mm longa; callo acuto, 1.2–1.3 mm longo; aristae rectae, centralis 32–40 mm longa, laterales 26–32 mm longae.

Perennial, caespitose, 24–46 cm tall. Sheaths longer than the internodes, glabrous, sparsely long bearded at the summit especially in the innovations, with deciduous hairs; ligule ciliate, ca. 0.2 mm long; collar glabrous; blade 10–33 cm long, 0.2–0.35 cm wide, abaxially and marginally scabrous. Panicle dense and spikelike, 10–15 cm long, 5–6 mm wide, erect. Glumes lanceolate, acute, short awned, 1-nerved, the lower 16–19.5 mm long (including the 4–6-mm-long awns), 0.7 mm wide (lateral view), densely scabrous, the upper one 13–15 mm (including the 2–2.5-mm-long awns), 0.5 mm wide, smooth. Lemma cylindrical, constricted and articulated at the base of column, 18–22 mm long (including the twisted and 10–15-mm-long column and the 1.2–1.3 mm, acute callus); callus hairy except for the upper 0.2–0.3 mm of the apex, which is glabrous and forms a conspicuous and curved beak; awns straight, the central one 32–40 mm long, the lateral ones 26–32 mm long. Palea hyaline, acute, 2-nerved, subequal to the lodicules, 1.4–1.6 mm long, 0.3–0.4 mm wide. Lodicules 2, hyaline, linear, 1.4 mm long, 0.1 mm wide. Stamens 3.

Distribution and ecology. According to the data presently available, *Aristida constricta* has a restricted distribution in southwestern Rio Grande do Sul, Brazil. It is common on basalt crevices and on the top and slopes of hills.

Paratypes. BRAZIL. RIO GRANDE DO SUL: Santana do Livramento, Cerro Armour, 17 Nov. 1987, *Longhi-Wagner et al. 1574* (ICN), Cerro Palomas, 25 Nov. 1972, *Valls & Barcellos 2527* (ESAL, ICN), Mar. 1991, *Valls et al. 12773* (CEN, ICN); São Francisco de Assis, 23 Nov. 1972, *Valls & Barcellos 2470* (ICN).

The most distinctive characteristic of *Aristida constricta* is the presence of a constriction at the base of the lemma column, which represents an articulation point; this allows the awns and column to be easily detached from the lemma.

Specimens of *A. constricta* have been cited as *A. trinii* Henrard by Severo (1982) for Rio Grande do Sul, Brazil. In fact, *A. trinii* was described from central Brazil and does not occur in Rio Grande do Sul. *Aristida trinii* has a subdense panicle and lacks an articulation at the lemmas.

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Guadua chacoensis (Poaceae: Bambuseae), its Taxonomic Identity, Morphology, and Affinities

Ximena Londoño
Instituto Vallecaucano de Investigaciones Científicos-INCIVA,
Apartado Aéreo 5660, Cali, Colombia

Paul M. Peterson
Department of Botany, National Museum of Natural History,
Smithsonian Institution, Washington, D.C. 20560, U.S.A.

ABSTRACT. A new combination, *Guadua chacoensis*, is made. Based on morphological evidence, *G. chacoensis* appears closely allied to *G. trinii*. A detailed illustration of the species is included, and morphological descriptions and illustrations of the seedling and fruit are provided.

Guadua was segregated from the genus *Bambusa* Schreber and described by Kunth (1822). Important diagnostic characters that distinguish this genus are triangular culm leaves in which the margins of the sheath and blade are usually contiguous, a distinctive band of short white hairs above and below the nodal line, synflorescences with 2- to many-flowered pseudospikelets, a palea of firm texture with prominent wings emanating from the keels, and the presence of stomata and papillae on the adaxial surface of the leaf blades (Soderstrom & Ellis, 1987; Soderstrom & Londoño, 1987). Other characters useful in distinguishing among the species of the genus are the shape of culm and foliage leaf, the structure and shape of pseudospikelets, and the habit of the plant.

Guadua occurs throughout tropical America, from Mexico to northern Argentina, and contains perhaps 30 species. Along with *Guadua*, four other genera are placed in the subtribe Guaduinae: *Criciuma* Soderstrom & Londoño and *Eremocaulon* Soderstrom & Londoño from Brazil, and *Olmeca* Soderstrom and *Otatea* (McClure & Smith) Calderón & Soderstrom, from Mexico (Soderstrom & Ellis, 1987).

Guadua chacoensis occurs in northern Argentina, southeastern Bolivia, and southern Paraguay and is one of the three southeasternmost species of the genus. It is frequently misidentified as *G. angustifolia* Kunth. The species was described in 1918 by the Argentinian botanist Nicolas Rojas Acosta as *Bambusa chacoensis*. A type specimen was not designated but the locality data (General Vedia, Depto. Bermejo, Prov. del Chaco–Argentina, and Ile de la Colonia Aquino, Río Paraguay) and the common name "tacuara," distinguish it from two species that occur sympatrically, *G. paraguayana* Doell, "picanilla," and *Guadua trinii* (Nees) Ruprecht, "yatevó," "tacuaruzú," or "tacuara brava" (Nicora & Rúgolo, 1987; Young, 1985).

McClure (1973), in his annotated checklist of species, included *G. chacoensis* under the heading of unresolved specific taxa. Young (1985) treated this species as one of two subspecies in the variable *Guadua angustifolia* Kunth complex and indicated a neotype. However, Young (1985) pointed out that "the two subspecies can be separated using a combination of vegetative and reproductive characters but since the morphological gap separating them is smaller than that separating most species in the subgenus, the taxa are considered here to be only subspecifically distinct."

In this study, a comparison of floral and vegetative morphology among *G. chacoensis*, *G. angustifolia*, and *G. trinii* is presented. Based on complete material collected by Camilo Quarin, a botanist from the Universidad Nacional del Nordeste, Corrientes, Argentina, a detailed illustration of the habit of *G. chacoensis* and descriptions and illustrations of the seedling and fruit are provided.

Guadua chacoensis (Rojas) Londoño & Peterson, comb. nov. Basionym: *Bambusa chacoensis* Rojas, Bull. Acad. Int. Géogr. Bot. 26: 157. 1918. TYPE: Argentina. Chaco: Departamento Bermejo, General Vedia, Riberas del Río de Oro, 23 July 1974, *Quarin et al. 2384* (neotype, designated here, CTES; isoneotypes, F, G not seen, MO, US). Figure 1.

Woody, thorny bamboo. *Rhizomes* pachymorph. *Culms* 10–20 m tall, 8–15 cm diam., green, erect below and arching apically; *internodes* hollow; *nodes* solitary; *bud* solitary, covered by a prophyll, positioned 2–4 mm above the nodal line. *Culm leaves*

Figure 1. *Guadua chacoensis* (Rojas) Londoño & Peterson. —A. Flowering branch. —B. Leaf complement. —C. Leaf ligule. —D. Culm sheath. —E. Detail of culm sheath ligule, adaxial view. —F. Branch complement. Based on: A, *Quarin et al. 2384;* B, C, *Schinnini 10956;* D, *Tressencs & Schinnini 1310;* E, F, *Schinnini et al. 6819.*

coriaceous, light brown to stramineous, deciduous, the blade ⅓–¼ as large as the sheath; *sheath* 20–50 cm long, 8–30 cm wide, abaxially strigose to glabrescent, the coarse, rigid, brown hairs to 2 mm long, easily removed, adaxially glabrous, shiny, and tessellate, auricles and fimbriae absent; *blade* 4–13 cm long, 3–8 cm wide, triangular, erect, persistent, strongly mucronate at the apex, abaxially strigose to glabrous, adaxially conspicuously nerved and pubescent between the nerves, the margins ciliate with hyaline, deciduous hairs, up to 2.5 mm long, the junction with the sheath slightly curved to ± horizontal; *inner ligule* 0.8–1 mm long, glabrous, stramineous, ciliolate along the margin, following the junction between the sheath and the blade and ending at the margins; *outer ligule* absent. *Branching* intravaginal; primary branch solitary and armed, later developing 2 or 3 secondary branches from the basal proximal nodes. *Foliage leaves* 7 to 9 per complement; *sheath* glabrous, nonauriculate, ciliate on the margins; fimbriae 2–3 mm long, restricted to the sheath summit, erect basally, wavy to curly distally, 3–5 per tuft, white-ivory; *blade* 10–24 cm long, 0.5–2.5 cm wide, L:W ratio 11–26:1, extremely variable in size, linear, 8–14-nerved, adaxially glabrous to sparsely hispid, the hairs 0.5–1 mm long, hyaline to brown, antrorse, 3–4 rows of prickle-hairs along one margin, abaxially glabrous, with sparsely coarse, rigid, hyaline hairs mainly along the midnerve, the margins strigose; *pseudopetiole* 2–3 mm long, adaxially pilose to glabrous, abaxially glabrous; *inner ligule* 0.2–0.4 mm long, minutely pubescent, ciliate on the margin with erect, hyaline hairs, the hairs 0.2 mm long; *outer ligule* 0.1–0.2 mm long, minutely ciliolate on the margin. *Synflorescence* 30–40(–50) cm long, usually terminating leafless branches, consisting of 6–9 coflorescences with 4–7 multiflowered pseudospikelets per coflorescence; rachis glabrous. *Pseudospikelet* 2–5(–6) cm long, 0.4–0.5(–0.6) cm wide, robust and erect, straight, corpulent, green when young, later brown to stramineous, consisting of a subtending bract, a prophyll, 1–2 glumes, 1–2 sterile lemmas, 2–4(–6) fertile florets, in a terminal rudimentary anthecium; *rachilla* 5–7 mm long between florets, hispidulous; *subtending bracts* 8–10 mm long, 4–5 mm wide, ovate to ovate-lanceolate, abaxially glabrous to sparsely pubescent, adaxially minutely pubescent on the distal ⅓, the apex mucronate; *prophyll* winged, pubescent between keels and ciliolate on the wings, occasionally gemmiferous; *glumes* 5–8 mm long, 3 mm wide, 1–2, usually gemmiferous, broadly ovate to ovate-lanceolate, 7–9-nerved, mucronate, positioned close to the prophyll, abaxially shiny, with scattered minute transparent hairs on the dorsal part, adaxially minutely pubescent, with transverse venations apically, the margins smooth; *sterile lemma* 10–14 mm long, 6–10 mm wide, sometimes enclosing a rudimentary palea, usually stramineous, mucronate, abaxially shiny and glabrous, adaxially minutely pubescent, the margins scarious, smooth; *fertile lemma* 12–16 mm long, 7–12 mm wide, ovate-lanceolate, 12–17-nerved, totally embracing the palea, mucronate, stramineous or purplish, abaxially covered with hyaline, appressed, sometimes spreading hairs on the proximal ½, otherwise glabrous and shiny, adaxially shiny, minutely pubescent, the margins scarious, shiny, bearing a tuft of hairs distally, below the mucro, the mucro 0.8–1 mm long, brown when old; *palea* 6–14 mm long, 2–4 mm wide, usually shorter than the lemma, stramineous, abaxially pubescent, adaxially glabrous, the sulcus 2–2.5 mm wide, 3-nerved, apiculate at the apex with a tuft of hairs, the keels winged, the wings 1–1.5 mm long, 2–3-nerved, stramineous, prolonged at the apex, ciliate on the margin, abaxially puberulous close to the keels, otherwise glabrous and shiny, adaxially glabrous, the enfolded margins 3-nerved, glabrous. *Lodicules* 3, transparent, many-nerved, glabrous, ciliolate on the upper part of the margin; the anterior pair 3–5 mm long, 2–3 mm wide, the posterior one 2–3 mm long, 1.5–2 mm wide. *Stamens* 6; anthers 5–8 mm long, 0.5–1 mm wide, sagittate at the base, apiculate at the apex of each theca, yellowish brown. *Ovary* 2–4 mm long, 1–2 mm wide, fusiform, glabrous and shiny; style 2–3 mm long, hispidulous, darker than the ovary with 3 plumose stigmas, the stigmas 3 mm long and purple when young. *Fruit* 9–12 mm long, 2.5–5 mm wide, an asymmetric fusiform caryopsis, brown, glabrous; embryo 2–3 mm long, 2–3 mm wide, basal, circular.

Distribution. Known from northern Argentina, southeastern Bolivia, and southern Paraguay where it occurs in gallery forests usually along stream and river edges at elevations of 75–450 m.

Additional specimens examined. ARGENTINA. CORRIENTES: Depto. Capital, Arroyo Riachuelo y Ruta 12, 16 Jan. 1974 (fl), *Quarin et al. 1859* (US), 15 Aug. 1974 (fl), *Quarin 2402* (MO, US); 21 Dec. 1974 (fl), *Maruñak 635* (US); 27 Nov. 1975 (fl), *Quarin 3125* (MO, US); Puente Pesoa, Arroyo Riachuelo, 3 Aug. 1973, *Schinnini et al. 6819* (US); Depto. Concepción, Rincón de San Pedro, 17 Dec. 1974 (fl), *Burkart et al. 30687* (MO, US), *Quarin 2870* (MO, US); Depto. Empedrado, Ruta 12 y Río Empedrado, 24 Oct. 1975 (fl), *Quarin 3210* (MO, US); Depto. Ituzaingó, Isla Apipé Grande, Pto. San Antonio, 8 Dec. 1974 (fl), *Krapovickas et al. 23851* (MO, US); Rincón Ombu Chico, 4 July 1974 (fl), *Krapovickas et al. 25470* (MO, US); Depto. Mercedes, 75 km N de Mercedes, Laguna Trin, 17–24 Oct. 1975 (fl),

Quarin et al. 3182 (US). MISIONES: vicinity of Pto. Aguirre, 100 m, 8–10 July 1914, *Curran 676* (F, NY, US); Pto. León, 75–100 m, 21 July 1914 (fl), *Curran 677* (NY, US); Iguazú, 7 Oct. 1910, *Rodriguez 486* (MO, NY, US); San Ignacio, Peñon Reina Victoria, 14 Jan. 1976 (fl), *Krapovickas & Cristóbal 28759* (MO, US). CHACO: Depto. Bermejo, Isla Guascará, 2 July 1981, *Tressens & Schinnini 1310* (US); Casa lata, 28 July 1944 (fl), *Rojas 11719* (NY). TUCUMÁN: Cultivado, Jardínes Instituto Miguel Lillo, procedente de Misiones, Iguazú, 26 Aug. 1976 (fl), *Cuezzo s.n.* (US). BOLIVIA. SANTA CRUZ: Prov. Sara, Río Surutú, 1 Oct. 1925 (fl), *Steinbach 7233a* (F, MO, US); Prov. Ichilo, 15 km SE of Buena Vista, 375 m, 28 July 1987, *Nee et al. 35397* (MO, NY); Parque Nacional Amboró, along Río Cheyo, 400 m, 24 ago. 1985 (fl), *Solomon 14021* (MO, US,); 23 km S of Buena Vista along Río Chonta, 420 m, 18 Nov. 1988 (fl), *Nee 36861* (NY); along Río Saguayo, 1.5–3 km NE of entrance into first Andean foothills, 17°38′–39′S, 63°43′W, 375 m, 21 Dec. 1988 (fl), *Nee 37301* (MO). PARAGUAY. CENTRAL: Ruta 2 y Arroyo Mboiy, 2 Mar. 1975 (fl), *Schinnini 10956* (US). PARAGUARÍ: sur le bord des ruisseaux, Dec. 1883 (fl), *Balansa 4346* (P, US). SAN PEDRO: Colonia Nueva Germania, 23 Oct. 1916 (fl), *Rojas 2311* (US); alto Paraguay, Primavera, 16 June 1957, *Woolston G-112* (NY). CAAGUAZÚ: Orillas arroyo Tebicuary, entre Coronel Oviedo y Colonia Independencia, 15 Oct. 1951 (fl), *Burkart 18741* (SI, US). ÑEEMBUCÚ: Barranca selvática del río Tebicuary-guazú, Jan. 1944 (fl), *Pavetti & Rojas 10959* (US).

Flowering. The incidence of flowering and fruiting in bamboos varies from one species to another (McClure, 1966), and according to records of specimens available at F, ISC, MO, NY, and US, *G. chacoensis* flowered in the following years: 1883, 1914, 1925, 1944, 1951, 1957, 1975–1976, 1981, and 1985–1988. We cannot establish a regular flowering cycle for this species; however, it is evident that after a long period without flowering, *G. chacoensis* can flower uninterruptedly for at least 3 years. Observations made by Quarin during 1974–1975 indicated that the flowering culms in *G. chacoensis* are usually leafless, and fruits and seedlings are produced when most of the plant is dry.

The flowering cycle of *G. trinii* appears to be unique and well known in the genus (McClure, 1966). It was reported by Parodi (1955), who personally observed the flowering cycle from the same hereditary line for a period of 30 years (1923–1953). After flowering and fruiting uninterruptedly for one year, the clump died completely (i.e., truly monocarpic). The fruits then fell to the ground and germinated.

The flowering cycle of *G. angustifolia* has not been established yet; however, observations of the flowering cycle of natural stands in Valle del Cauca and Quindio, Colombia, have been made by the first author every year from 1979 to the present. Not all the culms in a single clump flowered, and the flowering culms remain green or yellowish and continue to produce new foliage leaves. According to McClure (1966), a plant of *G. angustifolia* from Milagro, Ecuador, established under his direction at Chocolá, Guatemala, and Tingo Maria, Peru, had flowered annually during the dry season.

Fruit. The fruits of *G. chacoensis* fall on the ground, germinate, and grow beneath the parent plants. This suggests that the rate of survival of the seeds of *G. chacoensis* is higher than in other species of the genus, such as *G. angustifolia*, where it is comparably low (estimated at less than 1%). In *G. angustifolia*, the young ovary is often destroyed by insects.

Mature fruits of *G. chacoensis* are usually found in the middle section of the pseudospikelet and fall with the rachilla, lemma, and palea attached to the base. The caryopsis is asymmetrical and flattened on one side with a short prolongated, hirsutulous style that persists at the apex (Fig. 2S–2U). The dorsal surface of the fruit has a conspicuous hilum about as long as the fruit (Fig. 2U), and the ventral surface has a prominent embryotegium or covering at the base (Fig. 2T). A cross section of the fruit of *G. chacoensis* reveals the presence of a pericarp, endosperm, and embryo. The pericarp is thin, brown, and approximately 0.1 mm thick, whereas the endosperm is starchy, well developed, creamy-white, and occupies almost the whole diameter of the fruit (Fig. 2T). The embryo is ¼–⅕ the length of the whole fruit, cream-yellowish, and is located at the base of the fruit in a lateral position (Fig. 2T).

Upon germination of the embryo, the primary shoot is first to emerge laterally just above and adjacent to the root, and there is no internode between the caryopsis and the coleoptile. The primary shoot is a segmented axis of clearly positive phototropism and bears a foliar appendage at each node. The root grows sinuously downward, 12–15 cm, bearing many secondary adventitious roots throughout (Fig. 2W).

The seedling of *G. chacoensis* consists of, from the base upward, a coleoptile, the first basal culm leaf sheath with an elongated internode, the second basal culm leaf sheath with another elongated internode, followed by one culm leaf sheath with a broad, ovate-lanceolate blade positioned horizontally, one or several blades that develop into the first seedling leaf, and the terminal shoot (Fig. 2V). This morphological pattern seems to represent the developmental sequence of a typical bambusoid seedling (Calderón & Soderstrom, 1973).

Affinities. *Guadua chacoensis* appears to be most closely related to *G. trinii*, rather than *G. angustifolia*. However, in all three species the general

TABLE 1. A selective morphological comparison of *Guadua chacoensis*, *G. trinii*, and *G. angustifolia*.

Character	*G. chacoensis*	*G. trinii*	*G. angustifolia*
Culm leaf			
inner ligule	slightly curved and ending at the margins	more or less horizontal and ending at the margins	convex and ending before the margins
Foliage leaf			
blade size (cm)	10–24 × 0.5–2.5	4.5–11 × 0.4–1.3	11–21 × 1–2
l:w ratio	11–26:1	7–12:1	5–18:1
form	linear	linear	linear to lanceolate-ovate
Pseudopetiole			
length (mm)	2–3	1–2	2–5
adaxial surface	pilose to glabrous	pilose	short pubescent
abaxial surface	glabrous	pilose	glabrous
Pseudospikelet			
size l × w (mm)	2–6 × 0.4–0.6	1.8–4 × 0.4–0.6	4–10 × 0.3–0.4
form	robust and erect	robust and erect	slender and acute
Fertile lemma			
size l × w (mm)	12–16 × 7–12	9–12 × 5–7	9–10 × 5–6
margins	scarious, hairs at the distal end	papery, glabrous distally	papery, glabrous distally
mucro length (mm)	0.8–1	0.5–1	0.5
Palea			
size l × w (mm)	6–14 × 2–4	9–11 × 3	7 × 1–1.5
wing width (mm)	1–1.5	0.5	0.5
apex	prolongated	prolongated	not prolongated
Stamens			
length (mm)	5–8	5–7	4–5
apex	apiculate	apiculate	obtuse

form of the culm leaves, foliage leaves, and habit are similar.

Guadua chacoensis and *G. trinii* share the following characters: (1) a more or less horizontal junction between the culm blade and sheath; (2) a culm leaf inner ligule ending at the margins (Fig. 1D); (3) erect and robust pseudospikelets (Figs. 1A, 2A); (4) prolongation of the keels-winged at the apex; and (5) a monocarpic habit, commonly with a leafless flowering branch. *Guadua chacoensis* differs from *G. trinii* by having abaxially glabrous pseudopetioles, longer (10–24 cm) leaf blades that are generally wider (0.5–2.5 cm), and a lemma that is longer than the palea (Table 1).

Guadua chacoensis can be distinguished from *G. angustifolia* by having: (1) a slightly curved and continuous inner ligule ending at the margins; (2) a glabrous leaf sheath (Fig. 1C); (3) a conspicuously ciliate margin of the inner ligule of the foliage leaf (Fig. 1C); (4) an adaxially pilose to glabrous pseudopetiole; (5) erect and robust pseudospikelets; (6) a scarious margined lemma, with a tuft of hairs at the apex (Fig. 2I); (7) a prolongation of the keeled wings at the apex of the palea; (8) apiculate apex of each anther theca (Fig. 2P); (9) an asymmetrical, fusiform caryopsis (Fig. 2S); and (10) monocarpic, leafless flowering culms (Table 1). The geographic distribution of *G. chacoensis* is completely allopatric with that of *G. angustifolia*, which occurs in northwestern South America and Panama.

Acknowledgments. We are grateful to José Cuatrecasas, Emmet Judziewicz, Lynn Clark, and Lars Peter Kvist for advice and support during this study. Special thanks are given to Alice R. Tangerini for her skillful illustrations. Support for the first author was provided by a Smithsonian Institution Short-Term Visitor Grant.

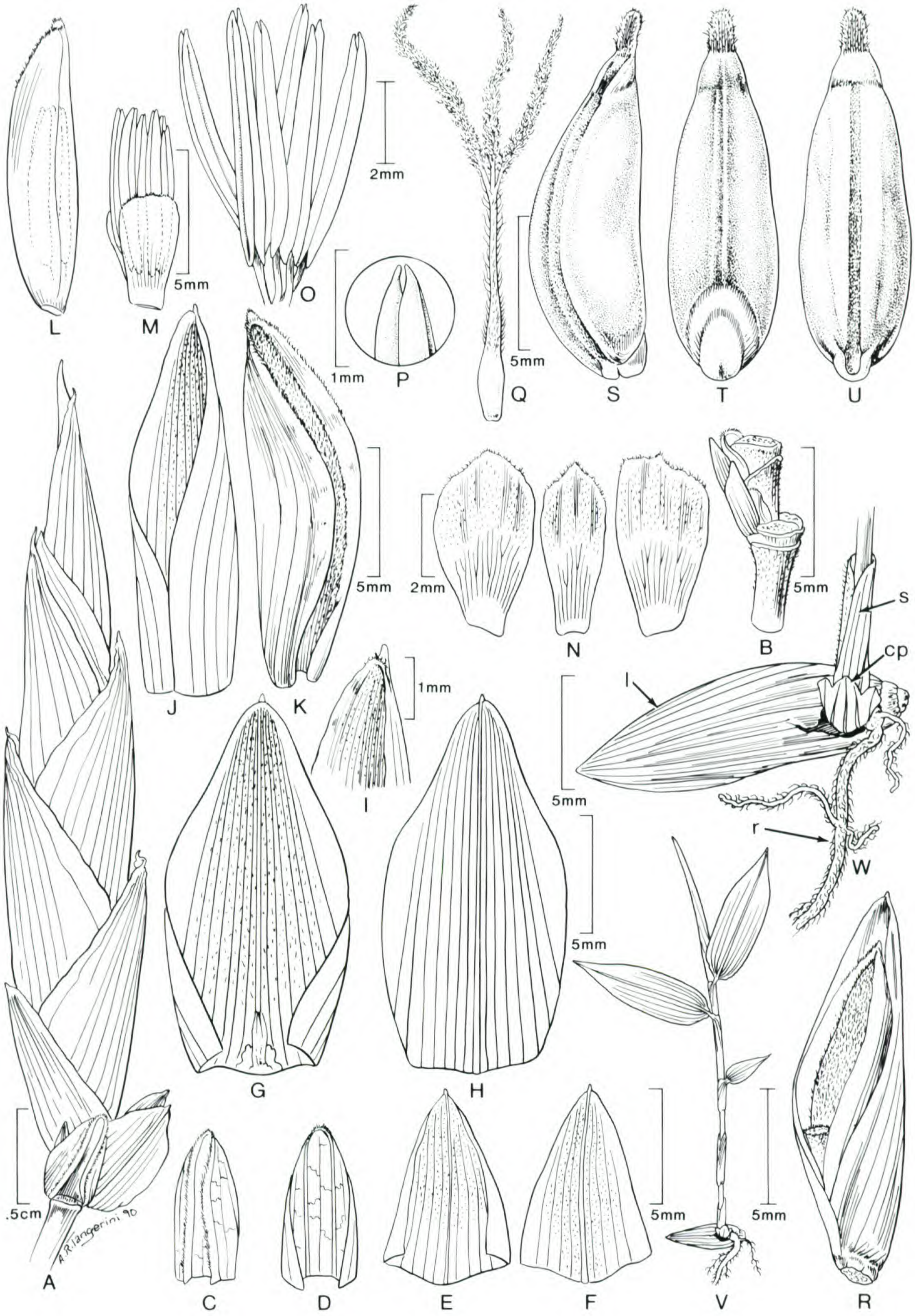

Figure 2. *Guadua chacoensis.* —A. Pseudospikelet showing prophyll, basal bracts, and florets. —B. Rachilla segment. —C. Prophyll, dorsal view. —D. Prophyll, ventral view. —E. Basal bract, ventral view. —F. Basal bract,

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dorsal view. —G. Lemma with a rudimentary palea below, ventral view. —H. Lemma, dorsal view. —I. Apex of lemma showing mucro and ciliolate margin. —J. Palea, ventral view. —K. Palea showing the ciliolate winged-keels, dorsal view. —L. Young palea enclosing androecium and gynoecium. —M. Young androecium and gynoecium protected by lodicules. —N. Lodicule complement. —O. Androecium with 6 stamens. —P. Anther apex. —Q. Gynoecium with 3 plumose stigmas. —R. Mature floret enclosing fruit with rachilla attached to the basal point. —S. Fruit with a short stylar column, lateral view. —T. Fruit showing the prominent embryotegium, ventral view. —U. Fruit showing the hilum, dorsal view. —V. Seedling showing the germinated caryopsis. —W. Detail of the basal portion of seedling showing the lemma attached to the fruit (l), the coleoptile (cp), the first basal culm-leaf sheath of the primary shoot (s) and the root (r). Based on: A–Q, *Quarin 3210;* R–U, *Quarin et al. 1859;* V, W, *Krapovicas et al. 23851.*

Una Nueva *Ayenia* (Sterculiaceae) con Nectarios Foliares de Costa Rica

Carmen L. Cristóbal
Instituto de Botánica del Nordeste, C.C. 209, 3400 Corrientes, Argentina

Nelson Zamora V.
Universidad Nacional de Costa Rica, Escuela de Ciencias Ambientales,
Apdo. 86-3000, Heredia, Costa Rica

María Mercedes Arbo
Instituto de Botánica del Nordeste, C.C. 209, 3400 Corrientes, Argentina

RESUMEN. Se describe y se ilustra *Ayenia mastatalensis* de Costa Rica. La anatomía de los nectarios se estudia y se compara con la de las otras especies del género con estas glándulas. Se discuten las relaciones taxonómicas entre las especies de *Ayenia* con nectarios.

ABSTRACT. *Ayenia mastatalensis* from Costa Rica is described and illustrated. The anatomy of its foliar nectaries is studied and compared with that of the other species in the genus with these glands. The taxonomic relationships between the species of *Ayenia* with nectaries are discussed.

Ayenia mastatalensis Cristóbal & Zamora, sp. nov. TIPO: Costa Rica. San José: Zona Protegida La Cangreja, Mastatal de Puriscal, 9°42′N, 84°20′W, 400 m, 4 Dec. 1986, *Zamora & Jiménez 1312* (holotipo, CR; isotipos, CTES, F, G, GH, K, MICH, MO, UC). Figuras 1, 2.

Frutex 2–3 m altus, ramis pilis simplicibus vel bifurcatis parvioribus et pilis setiformibus sparsis. Stipulae persistentes, deltatae, striatae, 2–8 mm longae × 0.7–1.5 mm latae. Petiolus 4–6 mm longus. Lamina ovalis-lanceolata ad apicem longe attenuata, 5.7–22 cm longa × 1.5–7.4 cm lata, plerumque integra, subglabra, nectario ovale, multiaperturato, 2–2.5 mm longo, in vena media hipophylli prope bassim invenitur. Ramuli floriferi 4–11 cm longi, terminales et axillares ut videtur nudi, 3–4 cymis umbelliformibus 5-floribus. Petali longe unguiculati, cucullo subtrapeziforme, apice integro; lamina petali linearis ca. 1.3 mm longa. Androgynophorus 3–4 mm longus. Stamina 5, antheribus trilocularibus. Staminodia cucullata margine exteriore acuto. Fructus aculeatus, ca. 11–12 mm longus × 10 mm latus, coccis dehiscentibus, monospermis. Semina anguste ovoidea.

Arbusto 2–3 m de alto, ramas delgadas y flexibles, las terminales con entrenudos de 1–3.5 cm de largo y 2–3 mm diám., con diminutos pelos erectos, simples o bifurcados y pelos setiformes simples, raro de más ramas, dispersos. Estípulas persistentes, coriáceas, membranáceas hacia el margen, 2–8 mm de largo, 0.7–1.5 mm de ancho, deltoideas, a veces prolongadas en un acumen acicular, cara interna lisa, cara externa estriada con las venas paralelas y sobresalientes, base pubescente como el tallo, pelos glandulares rojizos, muy pequeños y caedizos en el margen. Pecíolo 4–6 mm de largo, 1–1.3 mm diám., semiterete, algo abultado y oscuro en la mitad inferior, pelos pequeños dispersos en la cara interna sobre la línea media. Lámina membranácea, oval-lanceolada, subsimétrica, base redondeada, largamente atenuada hacia el ápice, 5.7–22 cm de largo, 1.5–7.4 cm de ancho, entera, excepcionalmente 1–5 dientes en el tercio apical, subglabra, epifilo con diminutos pelos simples sobre y a los lados de la vena media, hipofilo con escasos pelos setiformes y de dos ramas sobre las venas principales; venación sobresaliente en el hipofilo, 8–10 pares de venas laterales unidas formando arcos cerca del margen; nectario 2–2.5 mm de largo, 0.7–1 mm de ancho, ubicado sobre la vena media por encima del primer par de venas laterales, elíptico, levemente abultado, glabro, poros poco conspicuos. Ramitas floríferas 4–

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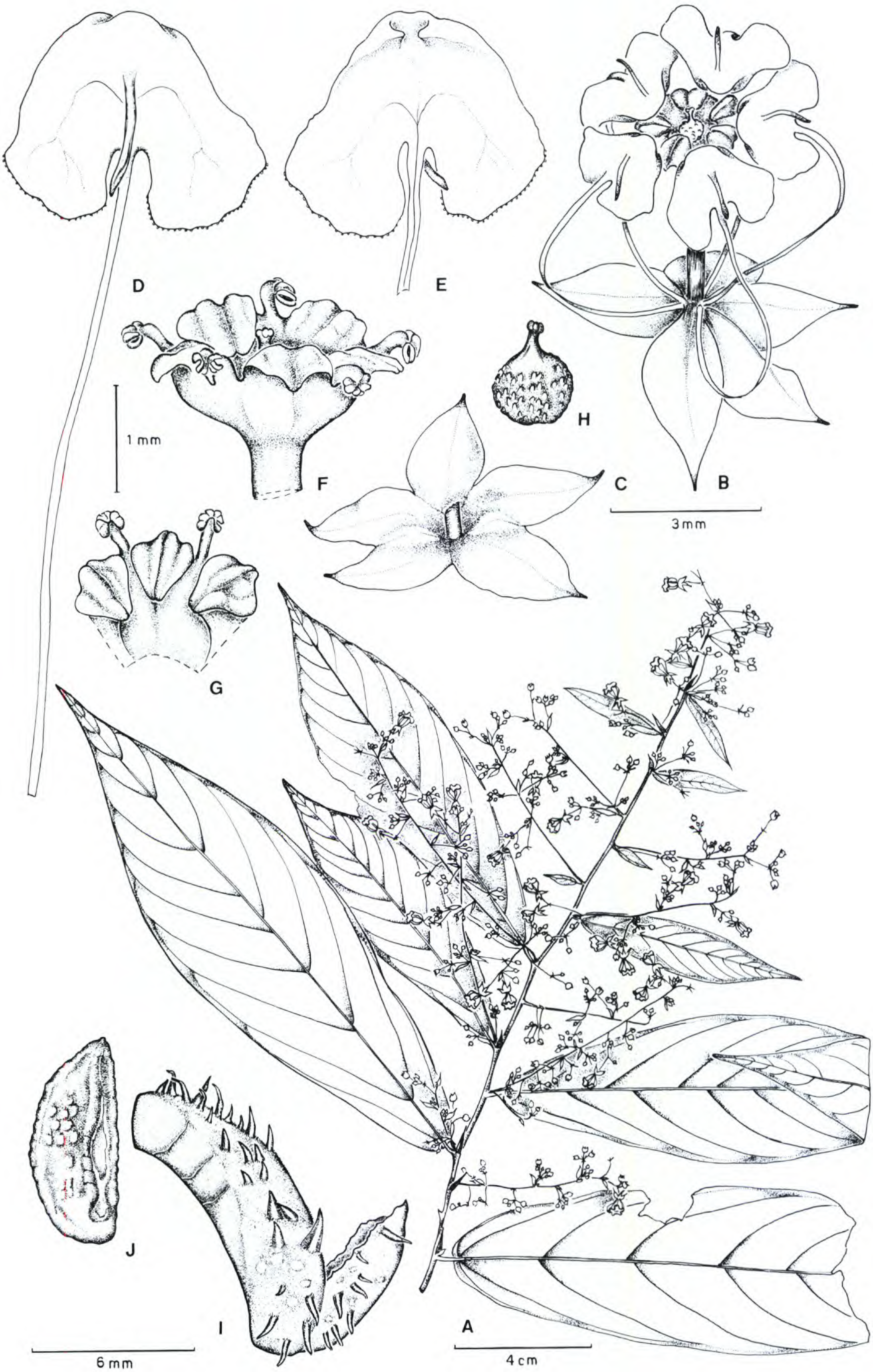
Figura 1. *Ayenia mastatalensis* Cristóbal & Zamora (*Zamora & Jiménez 1312*, CTES). —A. Rama. —B. Flor completa. —C. Cáliz, cara externa. —D. Pétalo completo, cara externa. —E. Porción superior de un pétalo, cara interna. —F. Tubo estaminal. —G. Porción del tubo estaminal, cara interna. —H. Gineceo. —I. Fragmento de un coco. —J. Semilla, cara ventral.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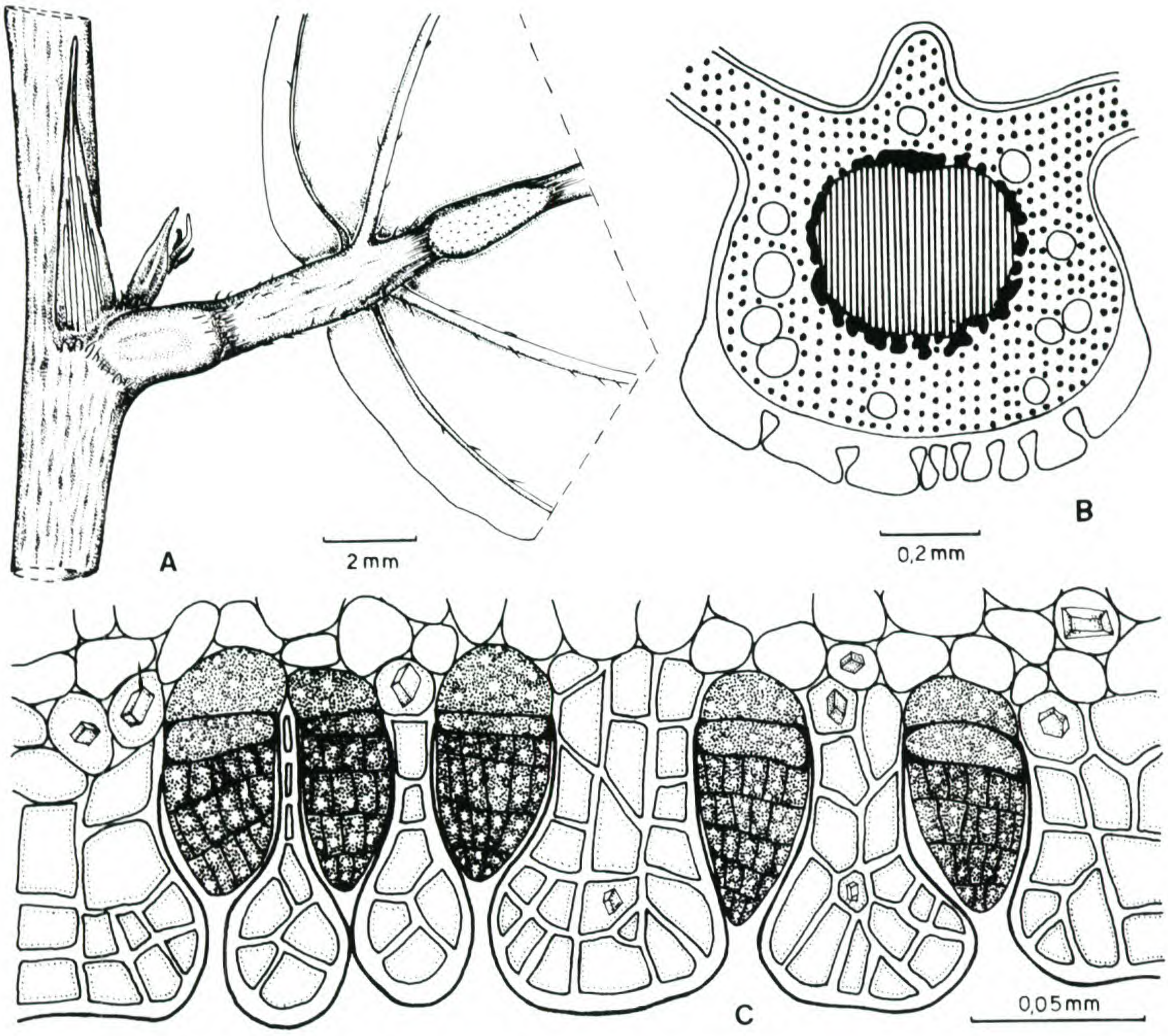

Figura 2. *Ayenia mastatalensis* (*Zamora & Jiménez 1312*, CTES). —A. Base de la hoja mostrando el nectario sobre la vena media. —B. Corte transversal de la vena media a la altura del nectario. —C. Detalle de la epidermis pluriestratificada y pelos glandulares.

11 cm de largo, terminales y axilares, dispuestas hasta en los 15 nudos apicales, las basales en la axila de hojas de tamaño normal, hacia el ápice las hojas se pueden reducir notablemente hasta 4–6 mm de largo, 1–1.5 mm de ancho; ramitas floríferas aparentemente desnudas, en cada nudo una hoja estipulada muy reducida y 3–4 cimas umbeliformes 5-floras, pedúnculos 5–10 mm de largo, pedicelos ca. 4 mm de largo, articulados en la parte media, glabros o pubérulos, brácteas subuladas, verticiladas, 0.5–1 mm de largo, escasos pelos en la cara externa y margen; ocasionalmente las ramitas floriferas originan en la base ramas de segundo grado de hasta 4 cm de largo. Alabastros globosos, 2–2.5 mm diám., ápice de los sépalos sobresaliente y coloreado, cara externa con pelos simples y de dos ramas, dispersos. Sépalos 5, membranáceos, verdosos, reflexos en la antesis, ca. 3 mm de largo, 1 mm de ancho, oval-lanceolados, agudos, ápice rojizo y algo engrosado, dos pares opuestos unidos hasta la mitad y el resto de los lados sólo en la base, cara externa con pelos simples y bifurcados largos dispersos, cara interna y acumen con pelos glandulares breves. Pétalos 5, rosado-lilas, largamente unguiculados, porción inferior de la uña filiforme, ca. 6 mm de largo, glabra, describiendo un semiaro; porción superior subtrapezoidal, ca. 2 mm de largo, 2.5 mm de ancho, adosada al borde del tubo estaminal, membranácea, margen inferior con los lóbulos redondeados y minúsculos pelos glandulares en el margen, ápice entero, redondeado, con dos dientes carnosos en la cara interna que abrazan la porción libre del filamento estaminal, el resto de la cara liso; lámina de los pétalos reducida a un apéndice algo

adelgazado en el ápice, ca. 1.3 mm de largo, inserto en la mitad superior de la cara externa, glabro. Androginóforo 3–4 mm de largo. Tubo estaminal campanulado, 1 mm de largo; estambres 5, opositipétalos, anteras tritecas en el extremo de una breve porción libre de filamento tan larga como la mitad del tubo estaminal; estaminodios 5, lóbulos algo carnosos e inflados, cuculados, perpendiculares al eje de la flor, ápice rodeando al estilo, margen externo agudo. Ovario globoso, cubierto de mamilas; estilo simple, breve; estigma capitado con 5 lóbulos inconspicuos. Cápsula 5-coca, subleñosa, ca. 11–12 mm de largo, 10 mm de ancho, pedúnculo y pedicelo ca. 9 mm de largo, cocos monospermos, dehiscentes a lo largo de la sutura ventral y ⅔ de la vena media, mitades incurvas y separadas entre sí, cara interna lustrosa con algunos pelos glandulares dispersos, en la cara externa aculeolos de 0.5–1.5 mm de largo ± cónicos, agudos, finamente pubescentes, caedizos con una porción de la capa superficial del pericarpo. Semillas castañas, angostamente ovoides, 8 mm de largo, 3.5 mm de ancho, caras laterales planas, algo reticuladas, cara dorsal convexa, lisa.

Anatomía de los nectarios foliares. En cortes transversales de hoja se observa que la vena media está ligeramente ensanchada a la altura del nectario (Fig. 2B).

El nectario es multiaperturado (Arbo, 1972) y consiste en un cojín de epidermis pluriestratificada de 5–6 capas de espesor, en el que se encuentran hundidos los pelos glandulares. Las células epidérmicas presentan paredes engrosadas, y algunas de ellas contienen cristales prismáticos (Fig. 2C); exteriormente están recubiertas por una cutícula gruesa, que tapiza además las cavidades en las que se encuentran los pelos glandulares. A veces se encuentran dos pelos juntos en una misma cavidad. Los pelos glandulares están formados por una célula basal voluminosa, una célula del cuello con engrosamientos periféricos de cutina en las caras tangenciales, y una cabeza aproximadamente cónica formada por 3–5 capas de células pequeñas, con contenido denso, granuloso. El parénquima subepidérmico presenta 7–8 capas de células con paredes delgadas, muchas de ellas con cristales prismáticos. Se encuentran algunas bolsas de mucílago entre el haz vascular y el nectario, y numerosas a los costados.

Los nectarios de *Ayenia mastatalensis* son muy similares a los nectarios de *A. klugii* Cristóbal & Arbo, aunque con menor cantidad de bolsas de mucílago en el parénquima subglandular. En las otras especies de *Ayenia* L. con nectarios con pelos glandulares, éstos son menos diferenciados, presentan menor número de capas de epidermis pluriestratificada, y las cavidades donde se encuentran los pelos son cilíndricas o infundibuliformes. También la forma de los pelos secretores es menos diferenciada en estas especies, pues la cabeza es cilíndrica o abultada en forma de clava, semejante a la de los pelos glandulares que se encuentran en otros órganos (Cristóbal & Arbo, 1971).

Paratipos. COSTA RICA. SAN JOSÉ: Zona Protegida La Cangreja, Mastatal de Puriscal, 9°42′N, 84°20′W, 400 m, 7 Nov. 1987 (fl), *Zamora, Chacón & Solís 1475* (C, COL, CR, CTES, MICH, MO, NY, SI, VEN), 2 July 1986 (fr), *Zamora, Sánchez & Berrocal 1171* (CR, CTES, MO).

El hallazgo de *Ayenia mastatalensis* es especialmente interesante ya que eleva a seis el número de especies del singular grupo de Ayenias con nectarios foliares. Dichas glándulas son características de *Byttneria* Loefl. (Cristóbal, 1976) y *Rayleya* Cristóbal (Cristóbal, 1981; Arbo, 1981), los dos géneros más relacionados con *Ayenia* L., de los cuales se diferencia, entre otros caracteres, por tener anteras tritecas.

Ayenia sección *Ayenia* se divide en cuatro subsecciones. Las especies de la subsección tipo no presentan nectarios, y las que los poseen están separadas en las tres subsecciones restantes, teniendo en cuenta principalmente los pétalos y los estaminodios (Cristóbal & Arbo, 1971).

Ayenia mastatalensis comparte la subsección *Stipulares* Cristóbal (Cristóbal, 1960), con las especies colombianas *A. cuatrecasae* Cristóbal (Cristóbal, 1962) y *A. stipularis* Triana & Planchon, por tener los estaminodios con el margen externo agudo y el ápice de la uña de los pétalos entero, mientras que en el resto de la sección *Ayenia* es escotado.

Las flores de *A. mastatalensis* son bastante semejantes a las de *A. cuatrecasae*, pero esta especie es pauciflora y sus hojas son aserradas desde la base y pubescentes. Pasa lo contrario si la comparamos con *A. stipularis*, ya que ambas tienen un aspecto general semejante dado por las hojas y la inflorescencia terminal. Las diferencias se encuentran en las flores: en *A. stipularis*, la porción superior de la uña de los pétalos es redondeada, con los lóbulos convergentes; la cara interna posee, debajo de los dientes, un área circular, levemente cóncava y papilosa donde se acomoda el estambre; la lámina del pétalo está ausente; el margen externo de los estaminodios es largamente acuminado, y la porción libre del filamento estaminal es casi tan larga como el tubo.

Con el fin de facilitar la comparación de *Ayenia mastatalensis* con las otras dos especies de la sub-

sección *Stipulares*, se resumen las diferencias en una clave que complementa la publicada para Ayenias con nectarios foliares (Cristóbal & Arbo, 1971).

1a. Pétalos con la lámina reducida a un apéndice inserto en el dorso de la región trapezoidal o subtrapezoidal de la uña.
  2a. Lámina foliar aserrada desde la base, pubescente; inflorescencias axilares, paucifloras ..... *A. cuatrecasae*
  2b. Lámina foliar entera, excepcionalmente con 1–5 dientes en el tercio apical, subglabra; ramas floríferas terminales y axilares, aparentemente desnudas, multifloras ..... *A. mastatalensis*
1b. Pétalos sin lámina; porción superior de la uña redondeada; inflorescencia terminal, desnuda, multiflora; hojas glabras, enteras o con dientes en el tercio apical ..... *A. stipularis*

A medida que aumenta el conocimiento de las Ayenias con nectarios foliares parece aumentar también la coherencia entre ellas. Por ejemplo, se presentan semejanzas de *A. mastatalensis* con *A. praeclara* Sandwith y con *A. klugii* por los frutos y los nectarios respectivamente, aun cuando las dos últimas especies corresponden por caracteres florales a la subsección *Praeclarae* Cristóbal.

De las seis especies con nectarios, sólo se conocen los frutos de *A. mastatalensis* y de *A. praeclara* (Perú, Pasco, Oxapampa, 24 Sep. 1982, *Foster 8915*, CTES). En ambas los frutos poseen aculeolos aproximadamente cónicos, a diferencia de los frutos de la sección *Ayenia* subsección *Ayenia*, donde son lineares. Los aculeolos de las dos especies antes mencionadas se aproximan por su forma a los de la sección *Cybiostigma* (Turcz.) Griseb., o más aún a los del género *Byttneria*. Los frutos de *A. praeclara*, especialmente, se parecen a los de este género por el tamaño de los cocos, hasta 2 cm de largo, la consistencia leñosa y los aculeolos punzantes. En cuanto a las semillas, en ambas especies son casi lisas, muy diferentes a las del resto de la sección *Ayenia* donde casi sin excepción poseen costillas.

Desde el punto de vista geográfico, la nueva especie aquí presentada parece ser, como sus afines, una rareza de área restringida. Vive en una mancha de bosque tropical muy húmedo, rica por su diversidad florística, y cuya exploración ha dado varias especies arbóreas nuevas para la ciencia. La presencia de esta *Ayenia* en Costa Rica marca un lugar intermedio entre Tamaulipas, México, localidad donde se encontró *A. conciliata* Cristóbal subsección *Conciliatae* Cristóbal (Cristóbal, 1969) y las áreas de las cuatro especies sudamericanas.

Como conclusión, debe dejarse abierta la posibilidad de unificar taxonómicamente estas Ayenias, jerarquizando la presencia del nectario foliar y el gran porte. El grupo podría constituir una sección independiente, vínculo entre *Ayenia* y *Byttneria*, con especies altamente diferenciadas, que responden a un esquema de variación muy diferente al de la subsección *Ayenia*.

Los detalles de las Figuras 1 y 2 fueron dibujados con cámara clara; piezas florales y nectario por C. L. Cristóbal, cortes anatómicos por M. M. Arbo, rama y pasado a tinta por Laura Simón.

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New Taxa of *Lonchocarpus* (Fabaceae: Milletieae) from the Venezuelan Guayana

Hans-Helmut Poppendieck
Institut für Allgemeine Botanik und Botanischer Garten,
Ohnhorststrasse 18, D-2000 Hamburg 52, Germany

ABSTRACT. Prior to the treatment of *Lonchocarpus* for the *Flora of the Venezuelan Guyana*, two new species endemic to the northern part of Estado Bolívar, Venezuela, and partly extending into adjacent Territorio Federal Delta Amacuro, are described: *Lonchocarpus crassispermus*, related to *L. hedyosmus*, and *Lonchocarpus imatacensis* from the subgenus *Neuroscapha*. In addition, *Lonchocarpus tubicalyx* is validated.

Lonchocarpus crassispermus Poppendieck, sp. nov. TYPE: Venezuela. Bolívar: 17 km de Upata sobre la carretera nueva Upata–San Felix, en las cercanías de los campamentos "El Paraiso" y "La Yagua," 24–28 km NE del caserío Los Rosos, "mahomo chino," Nov. 1965 (fr), *C. Blanco 382* (holotype, VEN; isotypes, MO, NY—2 sheets, US—2 sheets). Figure 1.

Arbor parva. Folia 9-foliolata, foliolis anguste ovatis, rugosis, marginibus distincte involutis, costa, marginibus et infra venis lateralibus pilosis. Inflorescentia terminalis, floribus geminatis. Corolla roseo-purpurea, epunctata. Vexillum basi distincte callosum. Ovula 4. Pedunculus fructus articulatus. Fructus 1–2-seminalis, indehiscens, aliquantum lignosus, lanceolatus ad oblongus, planus sed conspicue incrassatus circum semina, 7.5–12 cm longus. Semina reniformia 7–9 mm crassa.

Small evergreen tree. Leaves 9-foliolate; stipules caducous; petiole with rachis 7–9 cm long, pubescent. Leaflets firmly membranaceous, epunctate, narrowly ovate, rugose, margin distinctly involute, 3.5–7 × 1.3–2.3 cm, pilose on margin, central vein above, and on principal veins beneath. Inflorescences terminal on leafy shoots, strigose, spikes 8.5–17 cm long, peduncle 2.5–5 cm long. Flowers geminate; floral peduncle ± persistent after anthesis, 2.8–3 mm long; pedicel 2–3 mm long, with caducous subulate bracteoles above the midpoint. Calyx zygomorphic, 5-dentate with 3 triangular carinal and 2 obtuse vexillar teeth, punctate, strigose outside, glabrous within, 4–5 mm long. Corolla rose-purple, wing and standard petal strigose outside, wing and rarely keel petal sparsely dotted. Standard reflexed, clawed, lamina ovate to orbicular with prominent basal callosities, 8 × 8 mm. Staminal tube straight, filaments connate for ⅔ to ¾, anthers glabrous. Ovary densely sericeous, ovules 4. Fruit on jointed peduncle, 1–2-seeded, indehiscent, slightly woody, flat but abruptly and conspicuously thickened at the seed region, lanceolate to oblong, base attenuate, apex rounded and mucronulate, vexillar margin inconspicuously keeled, 7.5–12 cm long and 3.4–4 cm wide, at seed region 0.8–1 cm thick, otherwise 0.5–0.6 mm thick, ochre, slightly tomentose. Seeds thick, kidney-shaped, 1.1–1.5 cm long and 7–9 mm diam.

Distribution and phenology. Endemic to the northeastern part of Estado Bolívar, Venezuela, in moist to dry forests, 200–300 m; flowering in July and August, ripe fruits produced in November. Common names: Jebe, Mahomo chino.

Additional specimens examined. VENEZUELA. BOLÍVAR: 6 km S de El Perú, 15 km SE de El Callao, 300 m, 61°48′W, 7°18′N, 3 July 1960 (fl, lvs), *Little 17531* (MER); 17 km de Upata sobre la carretera nueva Upata–San Felix, en las cercanías de los campamentos "El Paraiso" y "La Yagua," 24–28 km NE del caserío Los Rosos (type locality), Aug. 1964 (fl, lvs), *Blanco 226* (NY, US, VEN); 7 km N de San Pedro de las Bocas, 200 m, 62°54′W, 7°00′N, "mahomo chino," 27 July 1978 (fl), *Liesner & González 5750* (MO); entre Encrucijada y El Pao, 62°40′W, 8°03′N, 28 Aug. 1954 (fl, fr), *Trujillo 247* (MER, S).

The small rugose leaflets, in combination with the large fruits and the nearly spherical seed, make this species unique. Flowers and inflorescences, however, agree well with both *Lonchocarpus hedyosmus* Miq., which extends from the Estado Guárico in Venezuela to the Guianas, and with the predominantly Colombian *L. macrocarpus* Benth., which has its eastern limit of distribution in Estados Zulia and Mérida.

Lonchocarpus imatacensis Poppendieck, sp. nov. TYPE: Venezuela. Territorio Federal Delta Amacuro: E de Río Grande, NE de El Palmar, cerca de los límites del Estado Bolívar, "Jebe," 13 Jan. 1965, *Marcano-Berti 560* (holotype, VEN; isotypes, MO, NY, VEN). Figure 2.

Arbor magna sempervirens. Folia 5-foliolata. Inflorescentia terminalis, floribus geminatis. Corolla roseo-pur-

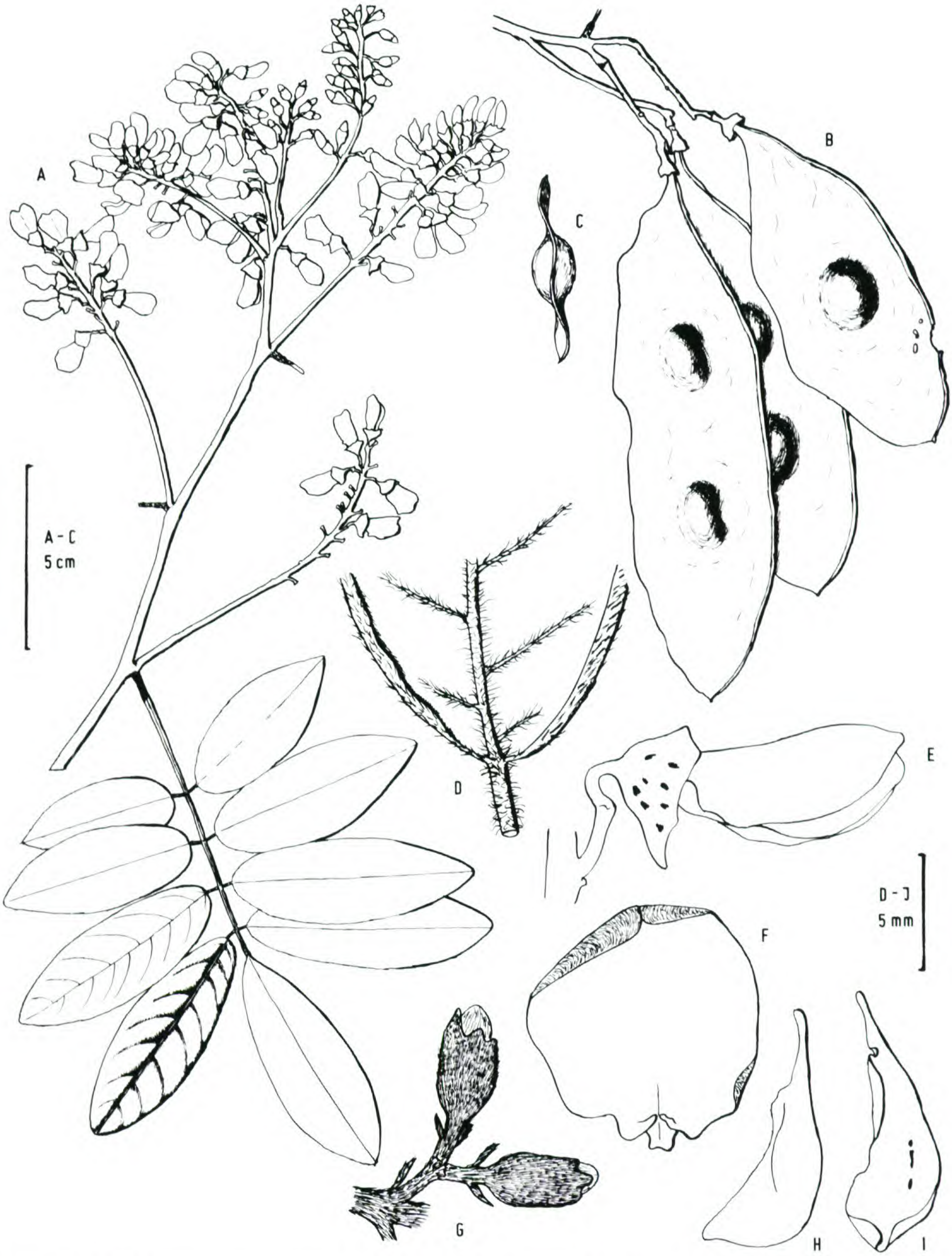

Figure 1. *Lonchocarpus crassispermus* Poppendieck. —A. Flowering branch. —B. Fruits. —C. Fruit, side view. —D. Leaf base, from below. —E. Flower, not yet expanded, indumentum left out to show glands on calyx. —F–I. Standard, floral buds, keel, and wing petal. (A from *Blanco 226*; B, C from isotype at NY; D–J from holotype.)

Figure 2. *Lonchocarpus imatacensis* Poppendieck. —A. Flowering branch. —B. Branch with mature fruits. —C. Details of inflorescence with flower buds. —D. Flower from below, to show indumentum and position of glands on keel petal; indumentum on calyx left out, as in E and F. —E. Flower, side view. —F. Flower, corolla removed. —G. Keel and wing petal, natural position. —H. Standard. (A from *Blanco 146*, after a drawing by B. Manara; B from isotype at NY, C–H from holotype.)

Figure 3. *Lonchocarpus tubicalyx* Pittier ex Poppendieck. —A. Branch, inflorescences, and new leaf. —B. Mature leaf. —C. Detail of inflorescence with flower buds. —D. Flower, indumentum on calyx left out to show lactifers. —E. Flower, standard petal removed. —F. Flower section of lower part. G–I. Standard, wing, and keel petal. —J. Staminal tube expanded. —K. Calyx expanded. (All from the holotype.)

purea, epunctata praeter 1–2 glandulas apice petalorum carinalium. Vexillum basi distincte callosum. Ovula 8–10. Pedunculus fructus articulatus. Fructus 1–7-seminalis, indehiscens, anguste oblongus ad lanceolatus, planus sed bullatus circum semina, (5.5–)11–14 cm longus. Semina reniformia, castanea, 1.8 mm crassa.

Large evergreen tree up to 26 m tall, trunk diameter up to 40 cm. Leaves 5-foliolate; stipules caducous; petiole with rachis 3.5–6.5 cm long. Leaflets membranaceous, not pellucid-punctate, ovate to obovate, base cuneate, apex bluntly acuminate, (2.5–)6–8(–9.5) × 2.5–5 cm, glabrous, veins prominent above. Inflorescences terminal on leafy shoots, glabrous, 9–14 cm long, peduncle 2.2–2.8 cm long. Flowers geminate; floral peduncle ± persistent after anthesis, 1.2–1.8 mm long; pedicel 1.3–1.7 mm long, with ovate, punctate bracteoles at the base of the calyx. Calyx cyathiform, truncate at base, epunctate, strigose outside, glabrous within, 3 mm long, 5 mm wide. Corolla rose-purple, strigose outside, glabrous within, epunctate except for one or two large glands on the abaxial side of the keel petal. Standard reflexed, clawed, lamina orbicular to subquadrate, apically sinuate to ⅛ of its length, with prominent basal callosities, 7–8 mm long and 3.2–3.5 mm wide. Staminal tube ± straight, somewhat persistent after anthesis, filaments connate for ⅔ to ¾, anthers glabrous. Ovary densely sericeous, 8–10-ovulate. Fruit on jointed peduncle, 1–7-seeded, indehiscent, flat but slightly bullate around the seeds, narrowly oblong to lanceolate, base stipitate, cuneate, apex rounded, obliquely acuminate, (5.5–)11–14 cm long and 1.3–1.8 cm wide, thickness at seed region 3.3–3.5 mm, dorsally 0.9–1.1 mm and ventrally 0.4 mm, dark ochre to castaneous, glabrous. Seed kidney-shaped, castaneous, 9 × 7 mm, 1.8 mm thick.

Distribution and phenology. Endemic to northern Estado Bolívar and the border with Territorio Federal Delta Amacuro, Venezuela; rainforests, 50–350 m; flowering May to July, fruits collected from November to January.

Additional specimens examined. VENEZUELA. BOLÍVAR: Altiplanicie de Nuria, on ± level forest on trail between El Cruzero and slightly beyond pica 101, ESE of Villa Lola, Jan. 1960 (lvs, fl), *Steyermark 86361* (NY, US, VEN); Sierra Imataca, Río Toro (Río Grande), between Río La Reforma and Puerto Rico, N of El Palmar, 14 Dec. 1960 (fr, lvs), *Steyermark 88036* (NY, US); alrededores del campamento "Las Pavas," arriba del Salto Pará, 6°12′N, 64°15′W, 22 May 1978 (fl, lvs), *Steyermark et al. 117181* (VEN). TERRITORIO FEDERAL DELTA AMACURO: NE de El Palmar, E de Río Grande, cerca de los límites del Estado Bolívar (type locality), June 1965 (fl, lvs), *Blanco 146* (MO, NY, VEN), 24 May 1964 (fl, lvs), *Marcano-Berti 194* (MO, NY, VEN), 26 May 1964 (fl, lvs), *Marcano-Berti 197* (MO, NY, VEN); Sierra Imataca, Cerro de La Paloma, E side of Río Cuyubini, vicinity of large granitic boulders, 18 Nov. 1960 (lvs, fr), *Steyermark 87647* (NY).

This species is peculiar because of the fruit, which is bullate around the seeds, which distinguishes it from the southern Brazilian *Lonchocarpus nitidus* Bentham, with which it has been misidentified. It belongs to subgenus *Neuroscapha* Pittier (= *Neuroscaphi* Bentham), the South American species of which form a series of closely related allopatric species whose ranges sometimes partly merge.

Lonchocarpus tubicalyx Pittier ex Poppendieck. TYPE: Venezuela. Apure: San Juan de Payara, arbusto de 4–5 m, 11 Feb. 1941 (fl, lvs), *Chardon 237* (holotype, VEN). Figure 3.

Arbor parva. Folia decidua, 7–11-foliolata, foliolis ovatis acuminatis, iuventute discoloribus: supra fuscatis, infra griseis strigosis glabrescentibus. Florescentia coaetanea, inflorescentia lateralis, floribus in verticillastris paucifloris dispositis. Calyx basin leviter inflatus, basin maculis lactiferibus punctatis. Corolla roseo-purpurea. Vexillum basin attenuatum, ecallosum. Ovula 5. Fructus ignotus.

Small deciduous tree 4–5 m tall. Bark gray. Leaves 7–11-foliolate; stipules caducous; petiole with rachis 10–15 cm long. Leaflets membranaceous, epunctate, ovate, apex bluntly acuminate, 4.5–8 × 2.2–3.5 cm, glabrous above, strigose to subglabrous beneath, young leaflets discolorous with blackish upper and grayish lower side. Flowering coaetaneous. Inflorescences lateral, in axis of old leaves, composed of 2–3 spikes on short shoots 1.5–2.5 cm long. Spikes 7.5–11.5 cm long with a sterile basal part 1.5–2.3 cm long. Peduncle reduced, flowers spaced so as to appear verticillate, pedicel 1.3 mm long, bracts 0.5–1 mm long, rounded to ovate. Calyx campanulate, slightly zygomorphic with upper margin undulate, lower margin 3-dentate and upper side slightly inflated, strigose outside, glabrous within, with prominent latex ducts especially at the base, 4–5 mm long and 3.5–6 mm wide at anthesis. Corolla purple, only slightly and sporadically pubescent. Standard orbicular, attenuate at base, without basal callosities, 5.5–7.5 mm long and 6.5–9 mm wide. Staminal tube 8–11 mm long, straight, filaments connate for ¾, base broadened, with two long dorsal slits. Ovary apically slightly bent, glabrous in the apical third of its length, otherwise strigose, ovules 5. Fruits unknown.

Distribution and phenology. Presently known from only two collections in Apure and Delta Amacuro, Venezuela, flowering in February.

Additional specimens examined. VENEZUELA. TERRITORIO FEDERAL DELTA AMACURO: Río Manimo, Vuelta Triste, 20 Feb. 1911 (fl, lvs), *Bond et al. 145* (GH, NY, US).

Since Pittier (1944: 102) lacked a Latin diagnosis, it is necessary to validate this name, but because of the lack of fruits some uncertainties remain. *Lonchocarpus tubicalyx* belongs to an aggregate of allopatric species with coaetaneous inflorescences, discolorous juvenile leaves, and purple flowers that usually can easily be differentiated by their fruits. The name is here applied to two widely separated collections, which are unique because of the very short pedicels by which the flowers appear to be arranged in verticillasters. This, and the somewhat smaller flowers, distinguish them from the Brazilian *L. denudatus* Bentham. Its Venezuelan and partly Colombian relatives *L. crucisrubierae* Pittier and *L. fendleri* Bentham (= *L. sanctae-marthae* Pittier) have obtuse leaves instead of acuminate ones. The two cited collections are almost identical except for slight differences in the size of the flowers, those from Delta Amacuro being at the upper and those from Apure being at the lower range of the measurements given above.

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Cryosophila macrocarpa (Palmae), a New Species from Chocó Department, Colombia

Randall J. Evans
University of Michigan Herbarium, Ann Arbor, Michigan 48109-1057, U.S.A.

ABSTRACT. A disjunct population of *Cryosophila* recently discovered in the Colombian Chocó is morphologically quite distinct from previously described *Cryosophila* species. Unique to the genus are its large fruits with large, deeply furrowed seeds. This new *Cryosophila*, *C. macrocarpa*, appears to be most closely allied to *C. guagara* of the Golfo Dulce area of Costa Rica and adjacent Panama.

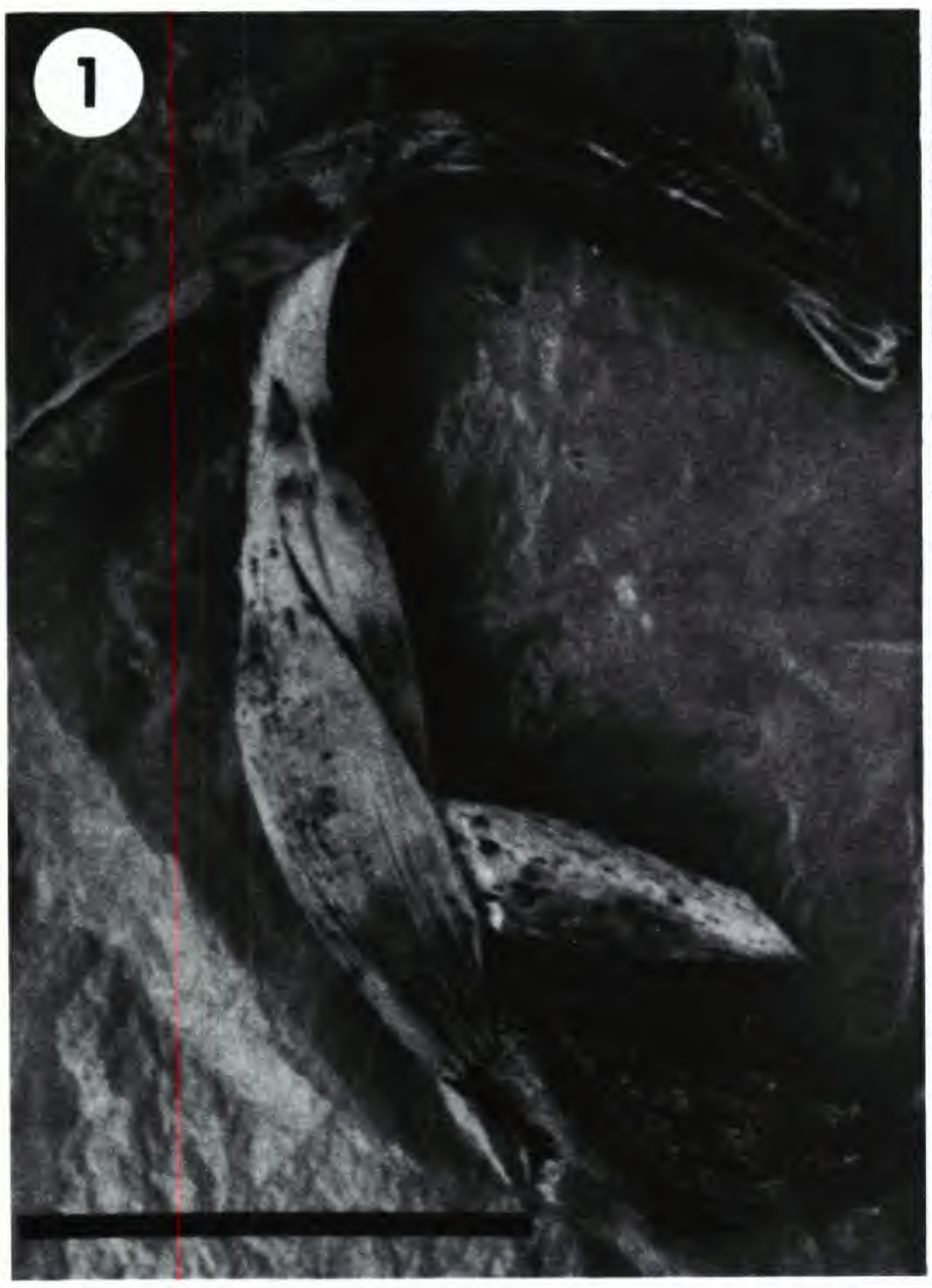
Cryosophila Blume comprises approximately 11–13 mostly narrowly endemic species of understory, primarily lowland wet forest palms distributed from Pacific coastal and southern Mexico to northwestern Colombia. The most distinctive generic characteristic is the usually branched, often numerous and long spines derived from roots that grow out of the normally solitary stem. Although the generic limits of *Cryosophila* are well defined, its species are poorly delineated. The difficulty arises because there are few characters that differentiate species. Most characters are either invariant (e.g., most floral characters) or continuously variable (e.g., the pattern and degree of stem armature and leaf blade splitting) across the genus. The most important diagnostic features are inflorescence shape and structure. Few species can be identified sterile, even in the field.

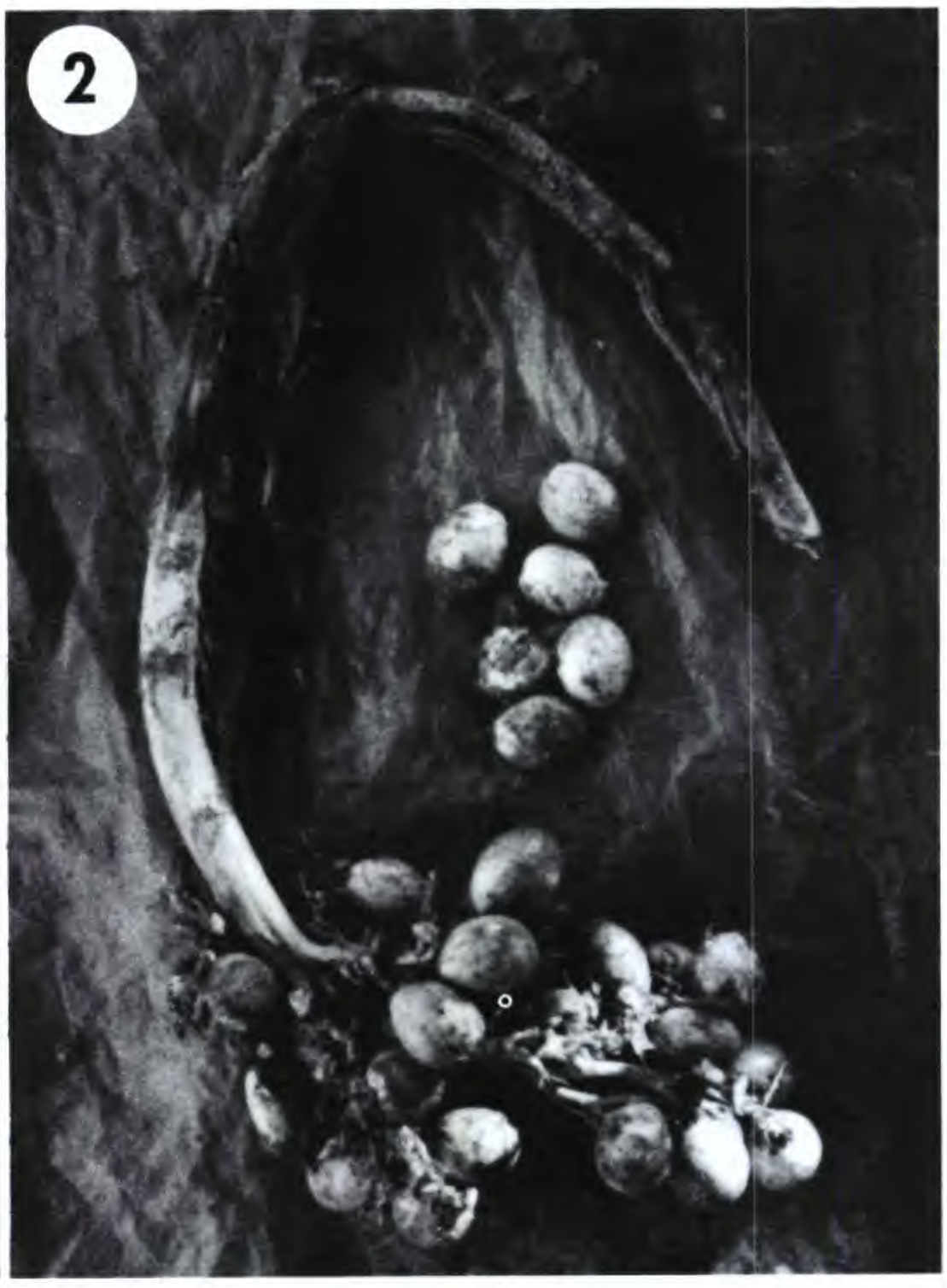
G. Galeano and R. G. Bernal (both of COL) recently discovered a disjunct Pacific coastal *Cryosophila* population (sterile at the time) near the town of El Valle in the Department of Chocó. While in Colombia conducting field studies as part of a monograph of the genus, I collected fertile material from this population possessing characteristics that clearly differentiate it from previously described species of *Cryosophila*.

Cryosophila macrocarpa R. Evans, sp. nov. TYPE: Colombia. Chocó: ca. 300 m S of Bahía Solano–El Valle road ca. 2 km from El Valle (ca. 500 m E of the bridge over Quebrada Tundó), elev. ca. 20 m, 6°07′30″N, 77°25′W, 6 Mar. 1991, *R. J. Evans & J. G. Ramírez 213* (holotype, COL; isotypes, JAUM, MICH, MO). Figures 1, 2.

A congeneribus fructibus majoribus (3.1–3.6(–3.7 in statu vivo) cm longis, 2.6–2.9(–3.0 in statu vivo) cm latis) et seminibus majoribus (2.5–2.7 cm longis, 2.1–2.3 cm latis) testis profunde sulcatis differt.

Solitary palm. Stem ca. 5 m long, erect or briefly decumbent, ca. 12 cm DBH, armed with root-spines distributed uniformly or not along length of stem; internodes not discernible. Root-spines 0–ca. 100 per 10 cm of stem, most to 18 cm (average 6–8 cm) long, occasional outliers to 55 cm long, almost always 1–2-times branched, usually descending, growing into soil at the stem base. Leaves ca. 30 in a spreading crown, ca. 6 distal to youngest inflorescence, 7–16 dead and pendulous; petiole rounded abaxially, channeled adaxially, 2.80–3.05 m long, 2.38–2.57 cm wide (fresh) at narrowest point just proximal to blade, splitting basally with age; basal sheath cream-colored, densely floccose, disintegrating and fraying into elongate fibers over time; hastula elevated, blunt, very depressed-triangular, 0.1–0.7 cm long, 2.9–3.8 cm wide, dorsally plicate and carinate; blade induplicately palmate, very broadly ovate in outline, 0.200–0.225 mm thick (fresh) adjacent to central margin 10 cm from apex of most recently fully expanded leaf, adaxial surface glabrous, abaxial grayish pubescent; central segments 126.5–158.0 cm long; lateral segments 85.0–110.5 cm long, ca. ⅔–¾ as long as central segments; central abaxial split to within (2.5–)4.0–6.0 cm of base, dividing blade into two ± equal halves of 29–32 segments each; primary adaxial splits less deep than central abaxial split with depth of splitting increasing from inner (ca. ¾–⅞ to base) to outer splits, dividing each half into 6–7 sections of 2–10 segments each, with the central sections containing (5–)8–10 segments each, the middle 3–4 sections of each half containing (3–)4–5(–6) segments each, and 2 the lateral-most sections of each half containing (2–)3–4(–5) segments each; secondary adaxial splits ¼–½(–⅔) to base; inner ca. 4 sections of each half fully divided; lateral section undivided; segments widest (4.1–4.6 cm wide ca. 40 cm from apex) near central abaxial split, narrowing toward the lateral segment, sometimes with slight constric-





Figures 1, 2. *Cryosophila macrocarpa* R. Evans (*Evans & Ramírez 213*). —1. Inflorescence with aborted flowers. —2. Infructescence with mature fruit. Scale bar = 20 cm.

tion distally, briefly bifid and often sub-sickle-shaped and diverging apically; longitudinal veins 10–14 per half-segment, 0.9–3.3 mm apart at widest portion (ca. mid-segment) of widest segments; longitudinal veinlets 3–7 between adjacent veins, 0.2–0.6 mm apart; irregular transverse commissures connecting longitudinal veins abundant and conspicuous abaxially and adaxially. Inflorescences with 3 orders of branching, interfoliar, ascending at emergence through split petiole base, then abruptly deflected; primary axis 62–78 cm long, cream-colored, densely floccose, 1.15–1.29 cm diam. at juncture of peduncle and rachis; prophyll lanceolate with truncate, sheathing base and acuminate apex, bicarinate, 23.5–25.5 cm long, persistent; inflorescence bracts with tubular base and cochleariform, apically acuminate blade, cream-colored, densely floccose, the 2 basal-most bracts ovate when detached and flattened, ca. 31 cm long, the bracts progressively smaller, particularly in width, toward apex, apical bracts very narrowly obovate; peduncle 50.0–57.5 cm long; peduncular bracts 4, persistent; peduncular bract scars slightly oblique; rachis 12.0–20.5 cm long; first-order branches ca. 10, broadly flattened perpendicular to primary axis, irregularly divided, to 7.5 cm long near base of rachis, shortening toward apex, each subtended by a deciduous bract; rachis bracts caducous apically, progressively more persistent toward base of rachis; rachis bract scars strongly oblique; rachillae to 5 cm long near base of rachis, shortening toward apex; rachillae bracteoles sheathing basally, irregularly shaped, 4.5–8.5 mm long, 0.5–1.5 mm wide just distal to basal sheath. Flowers perfect, 4.9–5.4 mm long, 3.8–4.8 mm diam., borne singly on pedicels 1.0–1.5 mm long, each subtended by a narrowly triangular to triangular bracteole 1.0–1.4 mm long, 0.4–0.7 wide; receptacle 0.6–0.8 mm long; sepals 3, acute, 4.3–5.3 mm long, connate basally ca. ⅓–½ their length; petals 3, cochleariform, thickened at center, hyaline at margin, stipitate, 2.6–3.1 mm long, 3.4–4.4 mm wide and flabelliform when detached and flattened, imbricate, adnate to calyx basally; stamens 6; filaments flat, 2.8–3.3 mm long, connate nearly to their apices in a hyaline, membranous, narrowly ampulliform tube 1.4–1.8 mm diam.; anthers briefly bifid at base and apex, 1.6–2.0 mm long, 0.6–0.9 mm wide, cream-colored, dehiscent laterally by longitudinal slits; carpels 3; ovary ca. 1 mm long, 0.5–0.7 mm diam.; stigma + style 1.9–2.8 mm long; stigma slightly expanded. Fruit oval, 3.1–3.7 cm long, 2.6–3.0 cm diam., cream-colored at maturity,

Figure 3. *Cryosophila* fruits (upper row) and seeds. Left to right: *C. macrocarpa* (*Evans & Ramírez 213*), note deeply sulcate testa; *C. warscewiczii* (*B. Jacobs 2351*), the second-largest-fruited *Cryosophila*; *C. guagara* (*Evans 207*), note shallow sulci; *C. kalbreyeri* (*Ramírez & Echavarría 3586*), the only other previously described Colombian *Cryosophila*. Scale bar = 2 cm.

epicarp smooth, mesocarp slightly fleshy, endocarp membranous; seed oval, 2.5–2.7 cm long, 2.1–2.3 cm diam., not adherent to the endocarp, the testa deeply sulcate.

Common name: Nolí, but this name is also used in the area for *Chelyocarpus dianeurus* (Burret) H. E. Moore, a much more common palmate-leaved palm. *Uses:* leaves used as thatch.

Additional specimen examined. Same population and date as holotype, *R. J. Evans & J. G. Ramírez 214* (BH, MICH, NY, US).

Known only from the type locality, an area of slightly disturbed lowland wet forest in the flood plain of the Río Valle near the northern extremities of the Golfo de Tribuga. Extensive primary forest remains in the immediate area as well as most of the entire Golfo de Tribuga coastal region, due to its remoteness. The area is very poorly known botanically and therefore *Cryosophila macrocarpa* may occur throughout the region. However, within its known bottomland habitat *C. macrocarpa* is very rare and localized, apparently occurring only in scattered small populations. *Cryosophila macrocarpa* does not occur on the nearby slopes where *Chelyocarpus dianeurus* is very common (nor does *Chelyocarpus dianeurus* occur in the bottomlands with *Cryosophila macrocarpa*). One local resident, knowledgeable enough to distinguish between these two superficially similar palmate-leaved species, reported *C. macrocarpa* to be more common on Cabo Corrientes than in the El Valle area. Cabo Corrientes delimits the southern end of the Golfo de Tribuga about 70 km to the south.

The large fruits and seeds with deeply sulcate seed coats of *Cryosophila macrocarpa* readily differentiate it from all other *Cryosophila* species (Fig. 3).

Cryosophila macrocarpa is morphologically most similar to *Cryosophila guagara* P. Allen of the Golfo Dulce and adjoining areas of southwestern Costa Rica and adjacent Panama. Character states shared by *C. macrocarpa* and *C. guagara* are abundant leaf blade cross-veins that are conspicuous both

adaxially and abaxially; short, broad, and flattened first-order inflorescence branches; and filaments that are connate nearly to their apices. *Cryosophila macrocarpa* inflorescences differ from those of *C. guagara* by their fewer peduncular bracts (4 in *C. macrocarpa* vs. 7–10 in *C. guagara*) and their comparatively shorter rachises containing fewer first-order branches (rachis $\frac{1}{5}$–$\frac{1}{4}$ the total inflorescence length containing ca. 10 first-order branches in *C. macrocarpa* vs. rachis $\frac{1}{3}$–$\frac{2}{3}$ the total inflorescence length containing ca. 30 first-order branches in *C. guagara*).

Whether or not the phenetic similarity between *C. macrocarpa* and *C. guagara* represents a close phyletic relationship should be resolved by a phylogenetic analysis of *Cryosophila* species (Evans, in prep.). If *C. macrocarpa* and *C. guagara* are demonstrated to be sister species within the genus, this would be another example indicating the floristic affinities between the Pacific lowland wet forests of the mostly Costa Rican Golfo Dulce area and the Colombian Chocó (Hartshorn, 1983).

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New Species and New Combinations of *Justicia* (Acanthaceae) from the Venezuelan Guayana

Dieter C. Wasshausen
Department of Botany, National Museum of Natural History, Smithsonian Institution, Washington, D.C. 20560, U.S.A.

ABSTRACT. Recent expeditions in the Venezuelan Guayana have resulted in additional new taxa in *Justicia* (Acanthaceae). The following places these novelties and new combinations on record for the convenience of other taxonomists prior to the publication of the *Flora of the Venezuelan Guayana*. Nine new Venezuelan species of *Justicia*, *J. breteleri*, *J. delascioi*, *J. huberi*, *J. monachinoi*, *J. nuriana*, *J. panarensis*, *J. parimensis*, *J. paruana*, and *J. uvida*, are described, illustrated, and compared with their closest relatives. In addition, two new combinations, *J. paraguazensis* and *J. moritziana*, are also necessary. A key to all of the known species of *Justicia* from the region (Territorio Federal Delta Amacuro, Estado Bolívar, and Territorio Federal Amazonas) is also provided.

Justicia is the largest and taxonomically the most complex genus of Acanthaceae, with between 420 (Mabberley, 1987) and 600 or so (Graham, 1988) species worldwide. The genus, named for eighteenth-century Scottish horticulturist and botanist James Justice, is distributed throughout the tropics and subtropics of both hemispheres, even into the temperate regions of North America, with one species extending as far north as Quebec, Canada. The taxonomic history of the genus is rather complex, and recently Graham (1988) attempted an overall schematic delimitation of the taxa in this assemblage of dissimilar elements. By utilizing characters of inflorescence, androecium, pollen, and seeds, she proposed the broadest definition of *Justicia* yet to date. Earlier, Nees (1847), in his major monograph of the family, divided the group into a number of smaller genera such as *Adhatoda*, *Amphiscopia*, *Beloperone*, *Leptostachya*, *Rhytiglossa*, and *Sericographis* in the New World. At that time he knew nothing about the markedly different types of pollen within the family that Radlkofer (1883) and Lindau (1895) later emphasized and used extensively in their taxonomic delimitation. Bremekamp (1948), after diligently studying the pollen types in the group, recognized most of the genera proposed by Nees. In addition, he described a number of new genera for the New World such as *Calliaspidia*, *Dyspemptemorion*, and *Psacadocalymma*. Currently the authors of most recent floras reject the delimitations proposed by Nees and Bremekamp. They seem to concur with Stearn (1971) that until correlations between character of inflorescence, floral characters, and pollen types have been analyzed for a large number of species throughout their ranges, and relatively homogeneous natural groups have been defined, the simplest course is to maintain *Justicia* as a large genus while recognizing the possibility of its later dismemberment and the revival of names now buried in its synonymy.

The genus is characterized by the 2 or 3 aperturate pollen with a trema area usually traversed by 2–8 rows of up to 10 insulae. This form of pollen was called "Knötchenpollen" by Lindau (1893). The plants are shrubs or herbs with the flowers variously disposed. In the region here covered, however, two basic inflorescence types are prominent: one consists either of a simple spike (sometimes terminal and axillary forming a cluster of spikes) with 2 flowers per node (or rarely a simple spike reduced to 1 or 2 sessile axillary flowers); the other is compound, composed of spicate units, which are usually secund and arranged along a main axis forming a rather large panicle. The floral bracts and bracteoles are of various shapes and sizes, imbricate or distant, and the calyx is 5-parted with the segments usually narrow and nearly equal. The corollas are gamapetalous and zygomorphic, with the tube divided above into 2 lips, the upper shallowly bilobed and the lower distinctly trilobed. There are two stamens and no staminodes; the anthers are variously 2-lobed with the thecae superposed or 1-lobed. The oblique connective varies in length and the lower thecae is usually spurred, apiculate, or muticous, occasionally much reduced. The fruit in *Justicia* is a 2-valved loculicidal capsule with usually 4 but occasionally 2 seeds. The lower portion of the capsule is commonly sterile and solid (capsule clavate), but in the Venezuelan Guayana we find a species in which the capsule is completely ovoid, without a solid basal stipate portion.

In the Venezuelan Guayana, most taxa of *Justicia* are limited to gallery forests and woodlands along banks of rivulets and swale margins at elevations between 100 and 1,400 m. Like many Acanthaceae, they are of local distribution in undisturbed forests and are rarely collected in secondary growth. This pronounced endemism explains why so many of the new taxa are only known from single collections. In an attempt to identify the recent collections of *Justicia* from the Venezuelan Guayana, I have found nine undescribed species of the genus.

KEY TO THE VENEZUELAN GUAYANA SPECIES OF *JUSTICIA*

1a. Capsule ovoid, without a solid basal stipitate portion, abruptly beaked at apex ..... 3. *J. nuriana*
1b. Capsule claviform (unknown for *J. huberi*, *J. delascioi*, and *J. panarensis*, but probably claviform), with solid basal stipitate portion, acute to obtuse or bifid at apex.
2a. Inflorescence diffuse, with numerous branches; bracts and bracteoles small, less than 2 mm long and 1 mm wide; low-growing herbs or undershrub; corollas usually less than 15 mm long.
3a. Corolla 4.5–6 mm long; inflorescence axillary and terminal, with branches 3–7 in whorl ... . *J. comata*
3b. Corolla 7–15 mm long; inflorescence mostly terminal, simple or with alternate branches.
4a. Flowers borne in spikes to 5 cm long; capsules ovate-stipate, 17 mm long; seeds suborbicular, 5 mm long, 5.5 mm wide, gray or flecked brown ..... *J. laevilinguis*
4b. Flowers borne in rather loose panicles 5–17 cm long; capsules clavate, 7.5–8 mm long; seeds suborbicular, 1.5 mm diam., light or reddish brown.
5a. Leaf blades ovate, decurrent on the petiole from a rounded base; panicles ca. 17 cm long and 15 cm broad; corollas yellow with faint rose on the lower lip, 9–10 mm long ..... 4. *J. monachinoi*
5b. Leaf blades narrowly to broadly lanceolate, acute to obtuse at base, not decurrent on the petiole; panicles 5–16 cm long and to 6 cm broad; corollas white, lilac, or purple, to 8 mm long ..... *J. pectoralis*
2b. Inflorescence dense, stout (or if somewhat lax, as in *J. parimensis*, then with corollas ca. 45 mm long); bracts and bracteoles conspicuous, more than 2 mm long and 1 mm wide; herbs, weak shrubs, or subshrubs; corollas usually more than 15 mm long (except in *J. cataractae*, *J. polystachya*, and *J. moritziana*, where corollas can be 10–13 mm long).
6a. Inflorescence a simple spike (sometimes terminal and axillary forming a cluster of spikes) with 2 flowers per node, a 2–3-flowered cyme, or reduced to 1 or 2 sessile axillary flowers.
7a. Inflorescence a congested terminal capitulum, sessile, subtended by 4 ovate leaf blades ..... 1. *J. paraguazensis*
7b. Inflorescence short spikes, cymes or clusters of spikes or thyrse, these pedunculate, not subtended by 4 leaf blades.
8a. Corollas white to pale purple, about 10 mm long.
9a. Bracts subulate, very narrow, 0.25 mm wide ..... *J. cataractae*
9b. Bracts oblanceolate or ovate, 3–7.5 mm wide.
10a. Bracts ovate, imbricate, 6.5–7.5 mm wide; spikes dense, 2–7 cm long, 1.5 cm wide ..... *J. polystachya*
10b. Bracts oblanceolate, not imbricate, 3 mm wide; spikes lax, 1–1.5 cm long, 0.5 cm wide ..... 2. *J. moritziana*
8b. Corollas red, purple, rose-lavender, glossy orange, never completely white, 15–60 mm long.
11a. Bracts and bracteoles conspicuously deep red or wine-colored.
12a. Flowers borne in dense, terminal spikes 3 cm long, these surrounded and partially hidden by the upper leaf blades; the blades imbricated, elliptic-oblong, 2.7–3.2 cm long and 1.4–1.6 cm wide, subcoriaceous; corollas 40–45 cm long ..... 5. *J. huberi*
12b. Flowers borne in axillary and terminal spikes 3.5–5 cm long, these (at least the terminal spikes) exceeding the upper leaf blades; the blades not imbricated, oblong to lanceolate, 6.5–8 cm long and 1.8–2.3 cm wide, firmly membranous; corolla 35–40 cm long ..... 7. *J. paruana*
11b. Bracts and bracteoles not conspicuously colored.
13a. Corollas 15–16 mm long.
14a. Leaf blades oblong, 11.5–16 cm long, narrowed at the base and decurrent on the petiole, subchartaceous; bracts and bracteoles 6–7 mm long, 0.5 wide; calyx segments 9–10 mm long, 1 mm wide ..... *J. hylaea*
14b. Leaf blades lanceolate to ovate, 5–8 cm long, obtuse or rounded at base, not decurrent on the petiole, membranous; bracts and bracteoles 5.5–6 mm long, 0.8–1 mm wide; calyx segments 6.2–8 mm long, 1.4–1.75 mm wide.

15a. Spikes moderately dense, the peduncles 1.8–8.8 cm long, corolla purple or red, the tube 4 mm wide, the upper lip cucullate, the lobes of the lower lip 1 mm long ..... *J. guianensis*

15b. Spikes dense, the peduncles 10–13.5 cm long; corolla rose-lavender, the tube 3 mm wide, the upper lip flat, the lobes of the lower lip 2 mm long ..... 8. *J. uvida*

13b. Corollas 25–60 mm long.

16a. Bracts conspicuous, ovate, oblong or oblanceolate, 2.25–10 mm wide.

17a. Flowers (2–3) borne in short, axillary and terminal cymes 1.5–2 cm long ..... 9. *J. delascioi*

17b. Flowers borne on one to several axillary and terminal compact spikes 2–7 cm long.

18a. Spikes short, 2–2.5 cm long; bract oblong, 2.25–3 mm wide; corolla glossy orange, yellow at base, about 50 mm long ..... 10. *J. breteleri*

18b. Spikes 2–7 cm long; bracts ovate or oblanceolate, 3–10 mm wide; corolla red, reddish purple, or violet.

19a. Corolla red, 40 mm long, the upper lip oblong to narrowly ovate, 18 mm long, the tube narrowly infundibuliform, about 28 mm long, 3 mm wide at base ..... 6. *J. panarensis*

19b. Corolla reddish purple or violet, the upper lip triangular ovate, about 10 mm long, the tube infundibuliform, about 10 mm long, 4 mm wide at base ..... *J. carthaginensis*

16b. Bracts inconspicuous, not readily distinguished from the bracteoles and calyx segments, linear lanceolate, 0.5–1.5 mm wide.

20a. Calyx segments green, 10.5–12.5 mm long, 1.75 mm wide, the cystoliths conspicuous under a lens; corolla glabrous; bracts and bracteoles puberulent, the trichomes whitish ..... *J. schomburgkiana*

20b. Calyx segments colored, 5 mm long, 0.75 mm wide, the cystoliths lacking or inconspicuous under a lens; corolla pubescent; bracts and bracteoles pilose, the trichomes brown ..... *J. kunhardtii*

6b. Inflorescence compound, composed of spicate units that are usually secund and arranged along one main axis.

21a. Spikes fascicled, forming in aggregate a loose terminal panicle ..... 11. *J. parimensis*

21b. Spikes not fascicled, inflorescence composed of spikelike racemes, the latter forming a rather large terminal panicle.

22a. Upper leaf blades conspicuously large, 24–30 cm long and 8–12 cm wide; panicles somewhat lax; bracts subulate, 2.5 mm long; corolla rich purple-pink .. *J. wurdackii*

22b. Upper leaf blades smaller, to 15 cm long and 4.5–6 cm wide; panicles rather dense; bracts triangular, 1.5 mm long; corolla dull crimson to brick red.

23a. Corolla 50–60 mm long, slightly curved, glabrous; calyx segments linear and tapering into a long point, 1 mm wide, glabrous or minutely puberulous, the trichomes, when present, glandular ..... *J. calycina*

23b. Corolla about 30 mm long, erect, sparingly puberulous; calyx segments oblong-lanceolate, 1.25 mm wide, hirtellous with a mixture of glandular and eglandular trichomes ..... *J. secunda*

1. Justicia (sect. *Simonisia*) **paraguazensis** Wasshausen, nom. nov. Replaced name: *Chaetochlamys wurdackii* Leonard in Mem. New York Bot. Gard. 10(4): 47. 1961, non *J. wurdackii* Leonard. 1961. TYPE: Venezuela. Bolívar: *Wurdack & Monachino 40985* (holotype, US).

2. Justicia moritziana Wasshausen, nom. nov. Replaced name: *Amphiscopia lancifolia* Tafalla ex Nees var. *minor* Nees in DC. Prodr. 11: 357. 1847, non *J. minor* T. Anders. 1864. TYPE: Venezuela. Caracas: *Moritz s.n.* (holotype, B destroyed).

3. Justicia nuriana Wasshausen, sp. nov. TYPE: Venezuela. Bolívar: Altiplanicie de Nuria, E of Cerro El Picacho, N of Las Nieves and Las Chicharras, 45 km N of Tumeremo, vicinity of Deborah, 600–650 m, 5–8 Feb. 1961, *Steyermark 89126* (holotype, US; isotypes, NY, VEN). Figure 1A–D.

Herba, caulibus quadrangularibus, glabris vel sursum puberulis. Foliorum lamina late oblonga vel ovata, acuminata, basi obtusa, membranacea, utrinque glabra vel subtus in costa et venis lateralibus parce puberula; petioli glabri vel parce puberuli; spicae graciles, terminales, pe-

Figure 1. A–D. *Justicia nuriana* Wasshausen (*Steyermark 89126*). —A. Habit. —B. Bracteoles and calyx segments. —C. Calyx segments, cupule, and glands. —D. Bracteoles, calyx segments, and capsule. E–G. *Justicia monachinoi* Wasshausen (*Wurdack & Monachino 39978*). —E. Habit. —F. Calyx, ovary, and pistil. —G. Bracts, bracteoles, calyx segments, corolla, and stamens.

dunculis subquadrangularibus, bifariam puberulis, rachidibus puberulis; bracteae et bracteolae triangulares, minute puberulae et ciliatae; calycis segmenta viridia, lanceolata, minute puberula et ciliata; corolla non visa; capsulae ovoidae, apice abrupte rostratae, aliquantum compressae, atropurpureae et nitidae, parce puberulae.

Herb to 1 m tall; stem erect, subquadrangular, glabrous below, becoming puberulous above, the trichomes retrorsely curved, subappressed, arranged ± in two rows. Leaves on petioles 2.5–6 cm long, these glabrous or sparingly and inconspicuously puberulous, the blades broadly oblong to ovate, 16.5–21.5 cm long, 5.5–10.5 cm wide, acuminate, obtuse at base, membranous, entire, dark green and glabrous above, dull paler green and glabrous below, the costa and lateral veins (7–9 pairs) inconspicuous above, raised and prominent beneath, sparingly puberulous, the cystoliths conspicuous under a lens and scattered on the upper surface, less conspicuous beneath. Flowers borne in slender spikes terminating the branches, 9–12 cm long, 1.5 cm broad, rather loose, the internodes 10–20 mm long, the peduncles 10–15 cm long, subquadrangular, bifariously puberulous, the trichomes retrorsely curved, subappressed, the rachis puberulous, the trichomes retrorsely curved; bracts triangular, 2 mm long, 1 mm wide, minutely puberulous and ciliolate; bracteoles triangular, 1.5 mm long, 0.7 mm wide near the base, puberulous and ciliolate; calyx green, deeply 5-segmented, the segments lanceolate, 6 mm long, 0.75 mm wide, minutely puberulous and ciliolate, distinctly 3-nerved; corolla wanting. Capsule ovoid, 13 mm long, 8 mm broad, 2–3 mm thick, abruptly beaked at apex, somewhat compressed, deep purplish and nitid when ripe, sparingly puberulous.

Distribution. Steep moist forested slopes over boulders, cloud forest just below the summit, Estado Bolívar, Venezuela, between 600 and 650 m. Known only from the type collection.

Justicia nuriana does not appear to be closely related to any of the known species of *Justicia* from the Guianas, Venezuela, or Colombia. Unfortunately, the new species is known only from fruiting material. However, since the ovoid capsule of this taxon is so distinctive, I feel that it is important at the present time to bring these unusual collections into the Acanthaceae literature.

4. Justicia monachinoi Wasshausen, sp. nov. TYPE: Venezuela. Estado Bolívar: Piedra Marimare, E bank of Río Orinoco opposite head of Isla El Gallo, 200 m, 19 Dec. 1955, *Wurdack & Monachino 39978* (holotype, US; isotype, NY). Figure 1E–G.

Suffrutex, caulibus quadrangularibus, glabris vel parce puberulis. Foliorum lamina ovata, acuminata, basi rotundata et in petiolum decurrens, membranacea, utrinque glabra vel subtus in costa et venis lateralibus parce puberula; paniculae terminales et axillares, aliquanto laxae, pedunculis et pedicellis puberulis; bracteae et bracteolae subulatae, puberulae; calycis segmenta linearia-lanceolata, puberula, ciliolata; corolla flava cum rosea diluta in labio inferiore, minute pubescens, labio superiore erecto, triangularo-ovato, minute bilobato, labio inferiore trilobato, lobis ovatis, rotundatis; stamina exserta; lobi antherarum superpositi.

Undershrub to 1.5 m high; stems somewhat branched, subquadrangular, glabrous or sparingly puberulous, the trichomes retrorsely curved, subappressed, occasionally gland-tipped. Leaves on petioles 1–2.5 cm long, these sparingly puberulous with appressed-ascending trichomes, the blades ovate, 6–11 cm long, 3–5.5 cm wide, acuminate, decurrent on the petiole from a rounded base, membranous, entire or undulate, yellowish green, both the upper and lower surface glabrous or sparingly and inconspicuously puberulous, the costa and lateral veins (5 or 6 pairs) bearing a few appressed-ascending trichomes, prominent and conspicuous on the lower surface, less so above, the cystoliths minute, scattered. Panicles terminal and axillary, forming a large complex inflorescence 17 cm long and 15 cm broad, the ultimate bracts subulate, 1 mm long and 0.4 mm wide, puberulous, the trichomes ± spreading; bracteoles subulate, 0.8 mm long and 0.25 mm wide, puberulous, the trichomes ± spreading; rachis and rachilla puberulous, the trichomes erect, occasionally gland-tipped; pedicels 0.5–1 mm long, puberulous; calyx deeply 5-segmented, the segments linear-lanceolate, 2.8–3 mm long, 0.5 mm wide near the base, puberulous and gland-dotted, the trichomes erect, ciliolate; corolla yellow with faint rose on the lower lip, 9–10 mm long, minutely pubescent, the tube about 1 mm broad at base, 4 mm broad at mouth, the upper lip erect, triangular-ovate, 3.5 mm wide at base, gradually narrowed to tip, this bilobed, the lobes about 0.2 mm long and wide, acute, the lower lip ± spreading, cuneate, 5 mm wide at base of lobes, these ovate, about 1.5 mm long and 1.5 mm wide, rounded at tip; stamens exserted about 2 mm beyond the mouth of the corolla tube, the anthers 2.5 mm long, the lobes superposed, vertically attached to a connective which itself is 1 mm long, glabrous, the lower thecae calcarate, the spur about 0.4 mm long, blunt; pollen grains 2-porate, bilateral, 44 × 22 μm, the pores circular, trema area microreticulate, traversed by 2 rows of 5 peninsulae (Fig. 3A). Capsule clavate, 7.5 mm long, 2.5 mm wide, 1.5 mm thick, puber-

ulous; seeds suborbicular, about 1.5 mm diam., 0.5 mm thick, light brown, tuberculate.

Distribution. According to label data locally frequent, Estado Bolívar, Venezuela, at 200 m elevation. Known only from the type locality.

Justicia monachinoi is perhaps most closely related to the widespread lowland species of *J. pectoralis* Jacq., which differs markedly by having a rather diffuse inflorescence with numerous very slender branches 5–16 cm long and to 6 cm broad, the corollas being white, lilac, or purple, to 8 mm long, with the throat transversely plicate, sometimes spotted with dark purple and the plants being weak stemmed herbs. In contrast, *J. monachinoi* has axillary and terminal panicles forming a large complex inflorescence 17 cm long and 15 cm broad, the corollas yellow with faint rose on the lower lip, 9–10 mm long and the plants being undershrubs with branched stems.

5. Justicia huberi Wasshausen, sp. nov. TYPE: Venezuela. Bolívar: Dist. Cedeño, Sierra de Maigualida, NE sector, high plateau tepuyana located on the headwaters of the Río Chajura, western affluent of the Río Erebato, 5°33′N, 65°13′W, 2,100 m, 28 Mar. 1988, *Huber 12731* (holotype, NY). Figure 2A–D.

Suffrutex, caulibus subquadrangularibus, glabris vel puberulis. Foliorum lamina imbricata, elliptico-oblonga, acuta, basi angustata, subcoriacea, supra glabra vel puberula, minute punctata, subtus in costa et venis lateralibus parce puberula; petioli breves; spicae terminales, densiflorae, deminutae foliorum laminae subtentae, pedunculis subquadrangularibus, dense puberulis; bracteae vinaceae, ellipticae, glabrae vel parce puberulae et ciliatae; bracteolae vinaceae, oblongae; calycis segmenta lanceolata, glabra vel parce puberula, ciliolata; corolla atrorosea, glabra, tubo anguste infundibuliformi, labio superiore erecto, oblongo vel anguste ovato, bilobato, labio inferiore trilobato, lobis oblongis, rotundatis; stamina exserta; lobi antherarum superpositi.

Shrub 0.5–1.5 m tall; stem erect, subquadrangular, glabrous or puberulous, the trichomes retrorsely curved, subappressed, sordid. Leaves on petioles 2–3 mm long, these puberulous with sordid, appressed-ascending trichomes, the blades imbricated, elliptic-oblong, 2.7–3.2 cm long, 1.4–1.6 cm wide, acute, narrowed at base, subcoriaceous, entire, the margins revolute, the upper surface lustrous, glabrous or bearing a few appressed trichomes, especially along the costa, minutely punctate, the lower surface sparingly puberulous especially along the costa and lateral veins (5–6 pairs), these obscure above and prominent and raised beneath, the trichomes adpressed-ascending, 0.2 mm long. Flowers borne in dense, terminal spikes 3 cm long and 1–1.5 cm broad, obtuse or rounded at tip, each flower cluster subtended by reduced leaf blades, the peduncles 10–12 mm long, subquadrangular, densely puberulous with sordid, appressed-ascending trichomes; bracts wine-colored, elliptic, 15–16 mm long, 8–9 mm wide, obtuse, narrowed at base, firm, nitid, glabrous or sparingly puberulous, the margins revolute, sparingly ciliate; bracteoles wine-colored, oblong, 10 mm long, 1.5–2 mm wide, glabrous or sparingly and minutely puberulous, the margins ciliolate, the costa and lateral veins prominent; calyx deeply 5-segmented, the segments lanceolate, 7 mm long, 1 mm wide, nitid, glabrous or minutely and inconspicuously puberulous, ciliolate; corolla deep rose-colored, 40–45 mm long, glabrous, the tube 3 mm broad at base, narrowed to 2.5 mm at 3 mm above base, thence gradually enlarged to 7.5 mm at mouth, the lips subequal, 22 mm long, the upper lip oblong to narrowly ovate, 11 mm wide near the base, 4 mm wide near the tip, bilobed, the lobes 0.5 mm long, rounded, the lower lip ± spreading, 3-lobed, the lobes oblong, 6 mm long, the lateral lobes 3.5 mm wide, the middle lobe 4 mm wide, all rounded at tip, delicately veined; stamens almost reaching the tip of the upper lip, the filaments flattened, glabrous, the anthers 4 mm long, the thecae 2.5 mm long, superposed, somewhat obliquely attached to the connective which itself is about 0.5 mm wide, both thecae terminating at base in a short blunt spur 0.25 mm long; pollen 3-porate, prolate to perprolate, 49 × 25 μm, the pores circular, the membrane reticulate, trema area studded with 2 rows of 5, ± circular insulae (Fig. 3B, C); ovary glabrous; style 3.5 cm long, glabrous; stigma minute, bilobed. Capsule wanting.

Distribution. Frequent in grassland, Estado Bolívar, Venezuela, at 2,100 m. Known only from the type locality.

Justicia huberi is closely affiliated with another Venezuelan species, *J. paruana* Wasshausen from Territorio Federal Amazonas, Cerro Sipapo, and Serrania Parú. In *J. paruana* the flowers are borne in axillary and terminal spikes 3.5–5 cm long, they are not subtended by the reduced leaf blades, the leaf blades are oblong to lanceolate, 6.5–8 cm long and 1.8–2.3 cm wide, firm and net-veined and the corollas are rose-colored, 35–45 mm long, and puberulous. In contrast, the flowers of *J. huberi* are borne in dense, terminal spikes 3 cm long, and each floral cluster is subtended by reduced leaf blades, the leaf blades are elliptic-oblong, 2.7–3.2 cm long and 1.4–1.6 cm wide, subcoriaceous, not net-veined,

Figure 2. A–D. *Justicia huberi* Wasshausen (*Huber 12731*). —A. Habit. —B. Bract. —C. Bracteoles and calyx segments. —D. Corolla and stamens. E–H. *Justicia panarensis* Wasshausen (*Boom & Grillo 6315*). —E. Habit. —F. Bract. —G. Bracteoles and calyx segments. —H. Corolla and stamens.

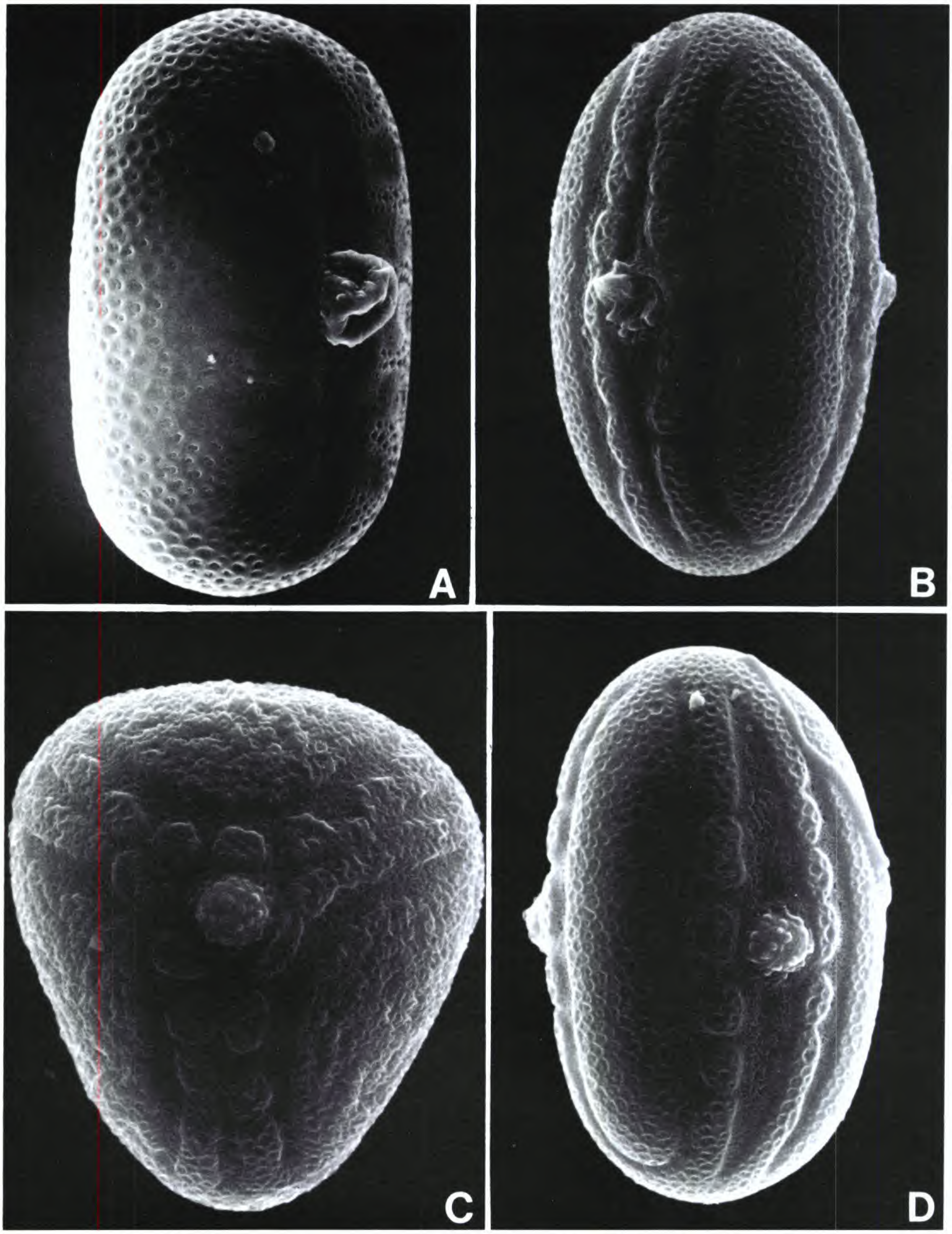

Figure 3. Scanning electron (SEM) photomicrographs of *Justicia* pollen. —A. *J. monachinoi*, equatorial view, ×2,000 (*Wurdack & Monachino 39978*). B, C. *J. huberi* (*Huber 12731*). —B. Equatorial view, ×1,700. —C. Equatorial view, ×2,000. —D. *J. paruana*, equatorial view, ×1,800 (*Maguire & Politi 28244*).

and the corollas are deep rose-colored, 40–45 mm long and glabrous.

6. Justicia panarensis Wasshausen, sp. nov. TYPE: Venezuela. Bolívar: Dist. Cedeño, vicinity of Panare village of Corozal, 6 km from Maniapure toward Caicara, 6°55′N, 66°30′W, 90 m, 11 Oct. 1985, *Boom & Grillo 6315* (holotype, US). Figure 2E–H.

Suffrutex debilis, caulibus subquadrangularibus, puberulis. Foliorum lamina oblongo-ovata, acuta vel breviacuminata, basi angustata, firma, supra parce puberula, subtus puberula, costa sicut venis lateralibus puberula et pilosa; petioli dense puberuli; spicae solitariae vel plures axillares et terminales, pedunculis et rachidibus subquadrangularibus, puberulis; bracteae viridae, ovatae, glabrae vel parce puberulae, parce ciliatae; bracteolae lanceolatae, glabrae vel parce puberulae, ciliatae; calycis segmenta lanceolata, ciliolata, parce puberula; corolla scarlatina, minute pubescens, tubo anguste infundibuliformi, labio superiore erecto, oblongo vel anguste ovato, bilobato, labio inferiore trilobato, lobis oblongis, rotundatis; stamina exserta; lobi antherarum superpositi.

Weak shrub 0.5 m tall; stem erect, subquadrangular, puberulous, the trichomes retrorsely curved, subappressed. Leaves on petioles 8–12 mm long, these densely puberulous with curved trichomes, the blades oblong-ovate, 5–7 cm long and 2.5–3 cm wide, acute to short-acuminate, narrowed at base, rather firm, entire or undulate, the upper surface sparingly puberulous, the lower surface moderately puberulous, occasionally interspersed with a few pilose trichomes, the costa and lateral veins (5–6 pairs) puberulous and pilose, the cystoliths often inconspicuous and scattered. Spikes one to several, axillary and terminal, 5–6 cm long and 2–2.5 cm broad, obtuse or rounded at tip, the peduncles 0.5 cm long, the rachis puberulous, the trichomes erect, white, about 0.3 mm long; bracts green, ovate, 19 mm long, 9.5–10 mm wide, acute, obtuse at base, thin, glabrous or sparingly puberulous, sparingly ciliate, the veins coarsely reticulate, these and the costa rather prominent; bracteoles lanceolate, 8 mm long, 2.5–3 mm wide, glabrous or sparingly and minutely puberulous, the margins ciliate, the costa prominent, the lateral veins delicately and coarsely reticulate; calyx 6 mm long, deeply 5-segmented, the segments lanceolate, 5.5 mm long, 1.2 mm wide, ciliolate, minutely and sparingly puberulous, the costa prominent; corolla red, 40 mm long, finely pubescent, the trichomes to 0.2 mm long, the tube 3 mm broad at base, narrowed to 2.5 mm at 3 mm above base, thence gradually enlarged to 5 mm at mouth, the lips subequal, 18 mm long, the upper lip oblong to narrowly ovate, 7.5 mm wide near the base, 1.5 mm wide near the tip, bilobed, the lobes 0.75 mm long, rounded, the lower lip ± spreading, 3-lobed, the lobes oblong, 14 mm long, 4.5 mm wide, rounded at tip, delicately veined; stamens exserted 8 mm beyond the mouth of the corolla tube, the filaments white, flat, glabrous, the anthers 3 mm long, the thecae 1.5 mm long, superposed, somewhat obliquely attached to the connective, this about 0.5 mm wide, the upper thecae muticous, the lower terminating in a short blunt spur 0.25 mm long; pollen 2-porate, prolate to perprolate, 60 × 30 μm, the pores circular, the membrane reticulate, trema area studded with 2 rows of 7–10, ± circular insulae (Fig. 8A, B); ovary glabrous; style 2.5 cm long, minutely puberulous at base. Capsule wanting.

Distribution. In semideciduous forest on granitic slopes and savanna, 90–400 m. Known only from the type locality.

Justicia panarensis superficially resembles *J. leucerythra* Leonard from Colombia. However, in *J. leucerythra* the bracts are firm, 8 mm wide, the corolla is pink or occasionally red, to 33 mm long, with the subequal lips 11 mm long, and the leaf blades are larger, 20 cm long and 6 cm wide. In *J. panarensis* the bracts are thin, 9.5–10 mm wide, the corolla is red, 40 mm long, with the subequal lips 18 mm long, and the leaf blades are much smaller, 5–7 cm long and 2.5–3 cm wide.

7. Justicia paruana Wasshausen, sp. nov. TYPE: Venezuela. Territorio Federal Amazonas: Serranía Parú, Río Parú, Caño Asísa, Río Ventuari, 1,800 m, 1 Feb. 1951, *Cowan & Wurdack 31116* (holotype, US; isotype, NY). Figure 4A–E.

Suffrutex debilis, caulibus aliquantum ramosis, subquadrangularibus, minute puberulis. Foliorum lamina oblonga vel lanceolata, acuminata, basi angustata, firma reticulato-venosa, utrinque glabra vel in costa et venis lateralibus parce puberula; petioli puberuli; spicae terminales et axillares, pedunculis subquadrangularibus, puberulis; bracteae vinaceae, ellipticae, glanduloso-puberulae et ciliatae; bracteolae vinaceae, oblanceolatae; calycis segmenta linearia, puberula, ciliolata; corolla rosea, puberula, tubo anguste infundibuliformi, labio superiore erecto, ovato, bilobato, labio inferiore trilobato, lobis oblongis, rotundatis; stamina exserta; lobi antherarum superpositi.

Weak shrub 1.5–3 m tall, somewhat branched; stems erect, subquadrangular, minutely puberulous, the trichomes antrorsely curved, subappressed. Leaves on petioles 9–15 mm long, these puberulous with appressed-ascending trichomes, the blades oblong to lanceolate, 6.5–8 cm long and 1.8–2.3 cm wide, acuminate, narrowed at base, firm, net-veined, entire or undulate, the margins revolute, the upper surface subnitid, glabrous or the costa bearing a few

Figure 4. A–E. *Justicia paruana* Wasshausen (*Cowan & Wurdack 31116*). —A. Habit. —B. Bract, bracteoles, and calyx. —C. Bracteole. —D. Calyx segments. —E. Corolla and stamens. F–J. *Justicia uvida* Wasshausen (*Steyermark & Aristeguieta 35*). —F. Habit. —G. Bract, bracteole, and immature corolla. —H. Bracteole. —I. Calyx. —J. Corolla and stamens.

small trichomes, the cystoliths minute, inconspicuous, the lower surface glabrous except the costa and lateral veins (5–6 pairs), these minutely and sparingly puberulous, on both surfaces the costa and lateral veins are prominent and conspicuously raised. Flowers borne both in axillary and terminal spikes 3.5–5 cm long and 1–1.5 cm broad, obtuse or truncate at tip, the peduncles 10–15 mm long, subquadrangular, puberulous, the trichomes erect; bracts wine-colored, elliptic, 14 mm long, 5–5.2 mm wide, acute to short acuminate, narrowed at base, puberulous with both glandular and eglandular trichomes, the margins ciliolate; bracteoles wine-colored, oblanceolate, 12 mm long, 2.5 mm wide, puberulous, the margins ciliolate, the trichomes occasionally gland-tipped; calyx deeply 5-segmented, the segments linear, 4.5 mm long, 0.5 mm wide, puberulous, ciliolate, the trichomes erect, occasionally gland-tipped; corolla rose-colored, 35–40 mm long, sparingly and inconspicuously puberulous, the tube 2 mm broad at base, narrowed to 1.5 mm at 3 mm above base thence gradually enlarged to 6 mm at mouth, the lips subequal, 17 mm long, the upper lip ovate, 7.5 mm wide near the base, narrowed toward tip, bilobed, the lobes 0.5 mm long, rounded, the lower lip ± spreading 3-lobed, the lobes oblong, 2.5 mm long, the lateral lobes 2 mm wide, the middle lobe 1.5 mm wide, all rounded at tip, delicately veined; stamens exserted 15 mm beyond the mouth of the corolla tube, the filaments flattened, glabrous, the anthers 4 mm long, the thecae 2.5 mm long, superposed, somewhat obliquely attached to the connective which itself is about 0.5 mm wide, both thecae terminating at the base in a short, white spur 0.25 mm long; pollen 3-porate, prolate to perprolate, 46 × 24 μm, the pores circular, the membrane reticulate, trema area studded with 2 rows of 4, ± circular insulae (Fig. 3D); ovary glabrous; style 3.2 cm long, glabrous; stigma minute, bilobed. Capsule clavate, puberulous, 12 mm long, 4 mm broad, 3 mm thick, the solid stipe 5 mm long and 2.5 mm broad, gland-dotted; seeds not seen.

Distribution. Occasional, in talus forest and woodland along streams at elevations between 1,600 and 1,800 m, in Territorio Federal Amazonas, Venezuela.

Paratypes. VENEZUELA. TERRITORIO FEDERAL AMAZONAS: Cerro Siapo (Paraque), N branch of Caño Profundo, 1,600 m, *Maguire & Politi 28227* (US); upper Caño Negro, 1,600 m, *Maguire & Politi 28244* (NY, US).

Justicia paruana is closely affiliated with another Venezuelan species, *J. huberi* Wasshausen from Estado Bolívar. Its relationship to *J. huberi* is described under that taxon.

8. Justicia uvida Wasshausen, sp. nov. TYPE: Venezuela. Bolívar: vicinity of km 128 S of El Dorado, NE of Luepa, 800–1,200 m, 6–11 Mar. 1962, *Steyermark & Aristeguieta 35* (holotype, US; isotype, VEN). Figure 4F–J.

Herba, caulibus ramosis, plus minusve patulis, quadrangularibus, glabris vel parce puberulis; folii lamina ovata, breviacuminata, basi rotundata, subchartacea, utrinque glabra vel subtus secus costam puberula; petioli breves; spicae terminales vel subterminales, densiflorae, contractae, pedunculis et rachidibus puberulis; bracteae et bracteolae lanceolatae, glabrae et ciliatae; calycis segmenta lanceolata, ciliata; corolla roseo-lavandulacea, infra glabra, sursum pilosa, labio superiore erecto, obovato-elliptico, apice bilobato, labio inferiore trilobato, erecto vel reclinato, obovato vel ovato, lobis obovatis, rotundatis; stamina exserta; lobi antherarum leviter superpositi.

Sprawling, subherbaceous, to 2 m tall; stems elongated, obscurely quadrangular, shallowly sulcate, at least above, glabrous or sparingly puberulous, the trichomes curved and subappressed, about 0.5 mm long, disposed ± in 2 rows, the internodes of the stem 3.5–10.5 cm long. Leaves sessile or very shortly petiolate; if petiolate then petioles 1–2 mm long, densely puberulous, the trichomes sordid, the blades ovate, 6.5–8 cm long and 3.5–4.7 cm wide, with the uppermost pair of leaves conspicuously reduced (2.5–3 cm long, 1.3–1.4 cm wide) and subtending the spikes, short-acuminate, obtuse or rounded at base, firm subchartaceous, entire or undulate, deep green and sulcate-nerved above, dull green with raised nerves (about 6 pairs) below, both surfaces glabrous or the costa beneath minutely and inconspicuously puberulous, the cystoliths of both surfaces inconspicuous under a lens. Flowers in short, dense spikes forming a compound spicate inflorescence 3–7 cm long and 2.5–3 cm wide including the corollas, the flowers fascicled, the rachises and peduncles rather densely and bifariously puberulous, the trichomes erect or ascending, about 0.2 mm long, the peduncles 10–13.5 cm long, the nodes of the spike bearing a pair of small leaves (their blades 13–22 mm long and 4–9 mm wide); bracts subtending the flowers lanceolate, 5.5–6 mm long, 1 mm wide, carinate, mucronulate at apex, firm, glabrous, the margin ciliate; bracteoles similar but slightly larger; calyx 8–9 mm long, deeply segmented, the five segments lanceolate, 6.25–8.25 mm long, 1.75 mm wide slightly above the middle, acuminate, the tip curved, the costa prominent, bearing dorsally a few glandular and eglandular trichomes, the margins ciliate, the trichomes whitish, erect or ascending, 0.5 mm long; corolla rose-lavender, 16 mm long, glabrous toward base, finely pilosulous toward tip, the trichomes spreading, to 0.4 mm long, the tube 6 mm long, 3 mm broad at base, gradually enlarged

to 4 mm at mouth, the upper lip obovate to elliptic, ± erect, about 11 mm long, 6 mm wide at middle, plicate, dorsally pilosulous, the trichomes glandular or eglandular interspersed, bilobed at tip, the lobes rounded, 0.5 mm long and 1 mm wide at base, the lower lip striped white and lavender, obovate to ovate, erect or reclinate, 12 mm long, 9 mm wide, 3-lobed, the lobes obovate, rounded, 3.5 mm long, the middle lobe 3.5 mm wide, the lateral lobes 2.5 mm wide; stamens exserted 8 mm beyond the mouth of the corolla, the filaments flattened and glabrous, the anther thecae slightly superposed, the connective 1 mm broad, the upper thecae 1.5 mm long, 0.5 mm broad, white-puberulous on the margin, muticous and minutely spurred at base, the lower thecae 1 mm long and 0.5 mm broad, white-puberulous on margin, terminating in a thecal appendage about 1 mm long; pollen triporate, subprolate to perprolate, 36 × 20 μm, the pores circular, the membrane reticulate, trema area inconspicuously studded with 2 rows of ± circular insulae (Fig. 6A); style about 14 mm long, minutely puberulous, the stigma minutely bilobed; ovary glabrous. Capsule clavate, 9 mm long, 3 mm wide, brownish, puberulous; seeds not seen.

Distribution. In gallery forest, along banks of rivulets and swale margins, Estado Bolívar, Venezuela, at 460–1,400 m.

Paratypes. VENEZUELA. BOLÍVAR: Gran Sabana, N of Uriman, 5°29′N, 62°36′W, 460 m, *Fernández 2548* (MYF, US); Depto. Piar, Río Karwai, around Irana-Waimáh, 20 km from Kavanayén, 1,200 m, *Ruiz-Teran & López-Palacios 11311* (MERF, US); Río Taratá, km 147–148 S of El Dorado, 1,220 m, *Gentry, Morillo & B. de Morillo 10554* (MO); ca. km 148 S of El Dorado, headwaters of the Río Aponguao, along Arauta-parú, 1,350–1,400 m, *Steyermark & G. C. K & E. Dunsterville 104157* (US, VEN).

Justicia uvida superficially resembles *J. maguirei* Wasshausen from Guyana. However, in *J. maguirei* the bracts and bracteoles are narrowly triangular, 2–3 mm long, the calyx segments 5.5 mm long, straight at tip and the corolla, probably purple or red, is 18–22 mm long with the lobes of the lower lip ovate, 3 mm long, the middle lobe 5 mm wide and the lateral lobes 3 mm wide. In contrast, *J. uvida* has bracts and bracteoles lanceolate, 5.5–10 mm long, the calyx segments are 6.25–8.25 mm long, the tips curved and the corolla is rose-lavender, 16 mm long with the lobes of the lower lip obovate, 3.5 mm long, the middle lobe 3.5 mm wide and the lateral lobes 2.5 mm wide.

9. Justicia delascioi Wasshausen, sp. nov. TYPE: Venezuela. Territorio Federal Amazonas: Depto. Atabapo, Salto Yureba, Caño Yureba, Bajo Ventuari, 4°3′N, 66°1′W, 120–150 m, 24 Oct.–4 Nov. 1981, *Delascio & Guánchez 10896* (holotype, US). Figure 5A–C.

Frutex vel suffrutex, caulibus subquandrangularibus, glabris. Foliorum lamina late lanceolata vel ovata, acuminata, basi angustata, firma, utrinque glabra vel parce puberula, costa et venis lateralibus puberulis; cymae axillares et terminales, pedunculis et pedicellis glabris; bracteae pedunculis subtentes foliaceae, ovatae, glabrae; bracteae floribus subtentes oblanceolatae, ciliolatae, glabrae; calycis segmenta oblonga vel elliptica, glabra; corolla lilacina, glabra vel minute glanduloso-pubescens, labio superiore erecto, ovato, bilobato, labio inferiore trilobato, lobis ellipticis, rotundatis; stamina exserta; lobis antherarum superpositis.

Shrub or subshrub, erect, 0.5 m tall; stem subquadrangular, glabrous. Leaves on petioles 1.5 cm long, these puberulous in two rows on the edge of channels, the trichomes retrorsely curved, the blades broadly lanceolate to ovate, 6.5–8 cm long and 2–2.7 cm wide, acuminate, narrowed at base, rather firm, entire or undulate, both the upper and lower surfaces glabrous or sparingly and inconspicuously puberulous, the costa and lateral veins (4 or 5 pairs) bearing a few appressed-ascending trichomes, inconspicuous on both surfaces, the cystoliths conspicuous under a lens and scattered on the upper surface, less conspicuous beneath. Flowers (2 to 3) borne in short axillary and terminal cymes, these 1.5–2 cm long, the peduncles 3.5–6 cm long, the secondary peduncles 6–9 mm long, both primary and secondary peduncles glabrous, subquadrangular, the angles rounded; bracts subtending the secondary peduncles leaflike, ovate, 8–15 cm long, 2–6 mm wide, acuminate at tip, glabrous without, minutely puberulous within, the petioles 2–4 mm long; bracts subtending the flowers oblanceolate, 10 mm long, 2 mm wide, ciliolate, glabrous, with scattered, brownish cystoliths visible under magnification; calyx deeply 5-segmented, the segments oblong to elliptic, 14 mm long, 4 mm wide near the middle, acuminate at apex, narrowed toward the base, coriaceous, glabrous, drying yellowish; corolla lilac, about 25 mm long, glabrous or minutely and inconspicuously glandular pubescent, the tube 13 mm long, 3 mm broad at base, 7 mm broad at mouth, the upper lip erect, ovate, 12–13 mm long, 7 mm wide, bilobed at apex, the lobes rounded, 0.5 mm long and wide, cucullate, enclosing the stamens, the lower lip 15 mm long and 1 cm wide at base of the 3 lobes, these elliptic, 7–8 mm long, 5–6 mm wide, rounded; stamens exserted 11 mm beyond the mouth of the corolla tube, the anthers 5.5 mm long, the thecae superposed, vertically attached to a connective which itself is 0.5 mm long, both thecae pu-

Figure 5. A–C. *Justicia delascioi* Wasshausen (*Delascio & Guánchez 10896*). —A. Habit. —B. Calyx. —C. Corolla and stamens. D–F. *Justicia breteleri* Wasshausen (*Breteler 4761*). —D. Habit. —E. Bract and calyx. —F. Bracteole, calyx segments, corolla, and stamens.

bescent, the lower thecae terminating in an appendage 1.75 mm long; pollen 2-porate, prolate to perprolate, 55 × 28 μm, the pores circular, the equatorial outline of the pollen with a distinct indentation at the equator, the trema region microreticulate (Fig. 6B); ovary puberulous; style 2 cm long, glabrous; stigma minute, bilobed. Capsule wanting.

Distribution. Known only from the type locality.

Justicia delascioi superficially resembles *J. hochreutineri* Macbride from Venezuela. However, in *J. hochreutineri* the flowers are borne in sessile or short-pedunculate axillary spikes, the calyx segments are oblong-lanceolate, setaceous-cuspidate, scabrous pubescent and drying green, and the bracts subtending the flowers are lanceolate and exceeding the calyx. In contrast, in *J. delascioi* the flowers are borne in axillary and terminal 2–3-flowered cymes on peduncles 3.5–6 cm long, the calyx segments are oblong to elliptic, acuminate, glabrous, and drying yellowish, and the bracts subtending the flowers are oblanceolate and shorter than the calyx.

10. Justicia breteleri Wasshausen, sp. nov. TYPE: Venezuela. Territorio Federal Amazonas: left bank of Sipapo River near confluence with Orinoco River, ±90 m, 20 Nov. 1965, *Breteler 4761* (holotype, US). Figure 5D–F.

Suffrutex, caulibus erectis, subquadrangularibus, glabris vel minute puberulis. Foliorum lamina oblonga vel elliptica, acuminata, basi obtusa, firma, supra glabra, subtus minute puberula costa et venis lateralibus subtus prominentibus; petioli puberuli; paniculae terminales, spicis parvis compactis compositae, pedunculis et rachidibus subquadrangularibus, puberulis; bracteae oblongae, ciliolatae; bracteolae oblongae vel oblanceolatae, ciliolatae; calycis segmenta oblonga, glabra et ciliata; corolla nitida aurantiaca, tubo luteo, sursum gradatim ampliato, subtiliter pubescenti, labio superiore erecto, oblongo vel anguste ovato, bilobato, labio inferiore trilobato, patulo, lobis oblongis, rotundatis; stamina exserta; lobis antherarum superpositis.

Partly climbing, weak-stemmed shrub 2–4 m tall; stem erect, subquadrangular, glabrous or minutely and inconspicuously puberulous. Leaves opposite or whorled, on petioles 1–1.5 cm long, these minutely puberulous especially in two rows on the edge of channels, the blades oblong to elliptic, 11–15 cm long and 4–5.5 cm wide, acuminate, obtuse at base, rather firm, entire, dark green and glabrous above, dull paler green and minutely puberulous below, especially the costa and lateral veins (7–9 pairs), these inconspicuous above, raised and prominent beneath, the trichomes erect, the cystoliths inconspicuous under a lens above, scattered and conspicuous under a lens below, the margins revolute; inflorescence a terminal panicle composed of several short, compact spikes 2–2.5 cm long (excluding corollas), the peduncles 1–3 cm long, subquadrangular, puberulous, the internodes of the inflorescence 6 mm long, somewhat flattened, 2 mm wide, puberulous; bracts oblong, 13–15 mm long, 2.25–3 mm wide, ciliolate, glabrous or minutely and inconspicuously puberulous; bracteoles oblong to oblanceolate, 10 mm long, 1.4 mm wide, ciliolate, glabrous or minutely and inconspicuously puberulous; calyx deeply 5-segmented, the segments oblong, 8–9 mm long, 1.75 mm wide near the middle, acute to acuminate at apex, slightly narrowed toward the base, glabrous, the margins conspicuously ciliate; corolla glossy orange, yellow at the base, about 50 mm long, the tube finely pubescent, 32 mm long, 2.5 mm broad at base, narrowed to 1.5 mm at 5 mm above base, thence gradually enlarged to 5.5 mm at mouth, the lips subequal, 17–18 mm long, the upper lip oblong to narrowly ovate, finely pubescent, 8 mm wide near the base, 1 mm wide near the tip, bilobed, the lobes 0.4 mm long, rounded, the lower lip somewhat spreading, 3-lobed, the lobes oblong, 4 mm long, 1.5 mm wide, rounded at tips, densely pilose, the trichomes erect or spreading, 1–1.3 mm long; stamens exserted 16 mm beyond the mouth of the corolla tube, the filaments flat, glabrous, the anthers 4.5–5 mm long, the thecae 2.5 mm long, superposed, somewhat obliquely attached to the connective, this 0.5 mm wide, the upper thecae muticous, the lower terminating in a short blunt spur 0.5 mm long; pollen grains 2-porate, bilateral, 60 × 25 μm, the pores circular, the trema area microreticulate, traversed by 4 rows of 6–7 small smooth insulae (Fig. 6C, D); style 4.7 cm long, glabrous. Capsule clavate (not seen at maturity).

Distribution. Rare and infrequent at edge of river and along roadsides in the Departamento Atures, Territorio Federal Amazonas, Venezuela, at elevations between 80 and 200 m.

Paratypes. VENEZUELA. TERRITORIO FEDERAL AMAZONAS: Depto. Atures, 2 km below Caserío San Pedro de Cataniapo, 50 km SE of Puerto Ayacucho, 5°38′N, 67°12′W, 100 m, *Guánchez 179* (US); vicinity of "Las Pavas," 25 km SE of Puerto Ayacucho on the road towards El Gavilán, 5°35′N, 67°27′33″W, 80 m, *Cuello 325* (US); mountainous region of la Coromoto, sector "El Tobogán," 37 km S of Puerto Ayacucho, 5°24′N, 67°35′W, 80–200 m, *Cuello 352* (US).

Justicia breteleri is not closely allied to the other known species of neotropical *Justicia*. It is perhaps nearest in relationship to *J. sanchezioides* Leonard from the Comisaría Putumayo, Colombia, and the

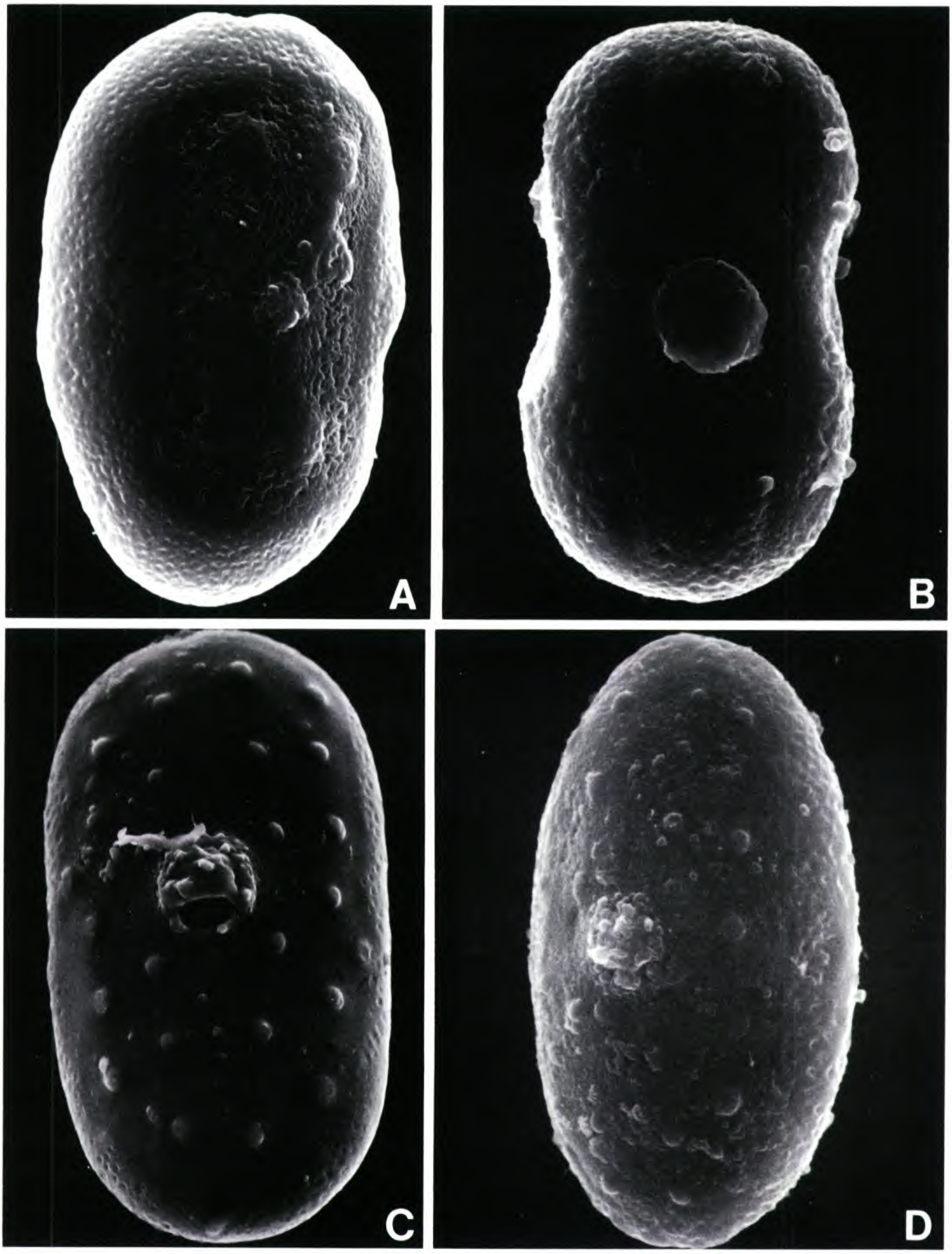

Figure 6. Scanning electron (SEM) photomicrographs of *Justicia* pollen. —A. *J. uvida*, equatorial view, ×2,500 (*Steyermark & Aristeguieta 35*). —B. *J. delascioi*, equatorial view, ×1,600 (*Delascio & Guánchez 10896*). C, D. *J. breteleri*. —C. Equatorial view, ×1,600 (*Breteler 4761*). —D. Equatorial view, ×1,800 (*Cuello 325*).

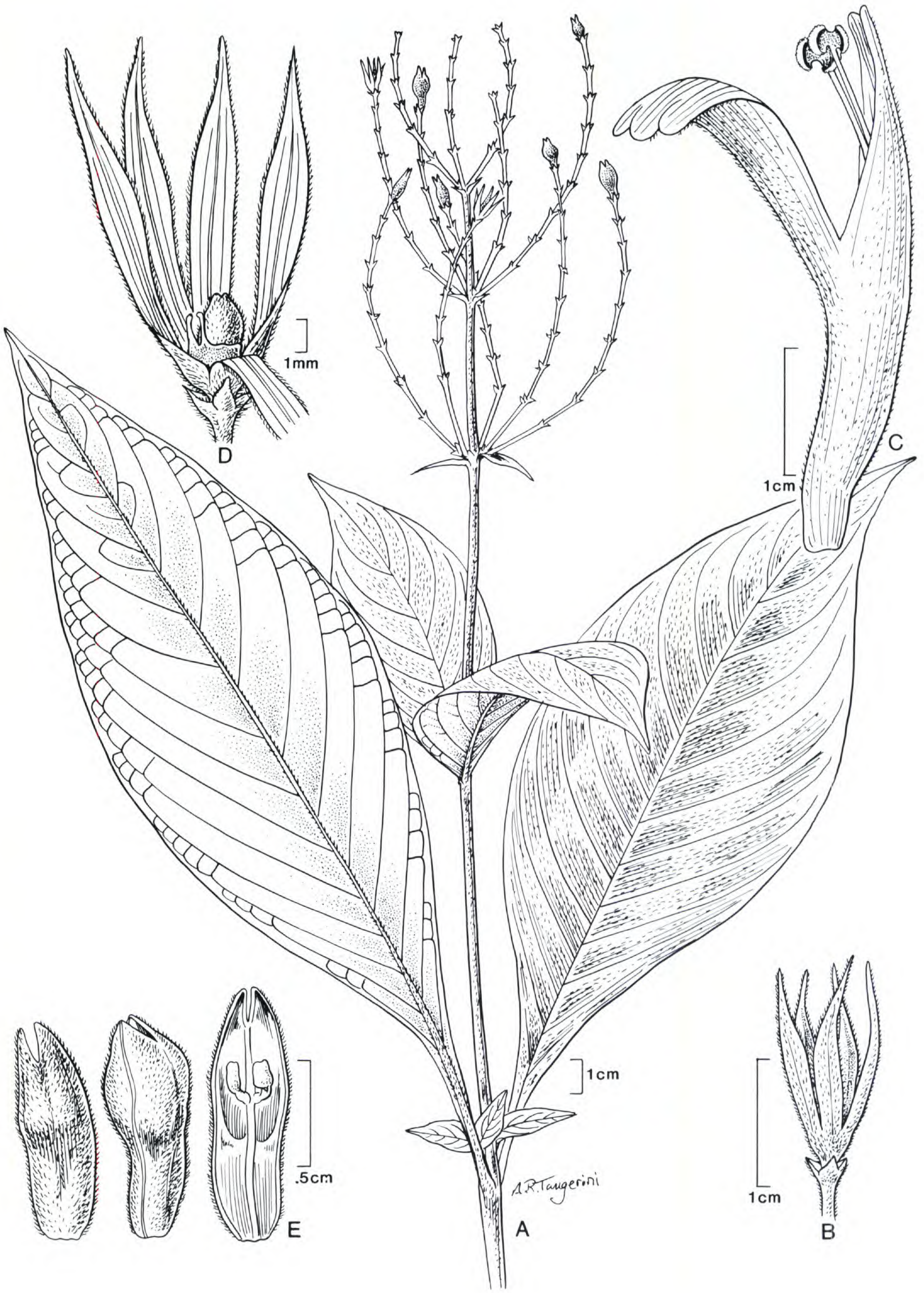

Figure 7. A–E. *Justicia parimensis* Wasshausen (*Huber & Colchester 8404*). —A. Habit. —B. Bracts and calyx. —C. Corolla and stamens. —D. Bracts, calyx segments, cupula, glands, and immature capsule. —E. Capsule and retinaculum.

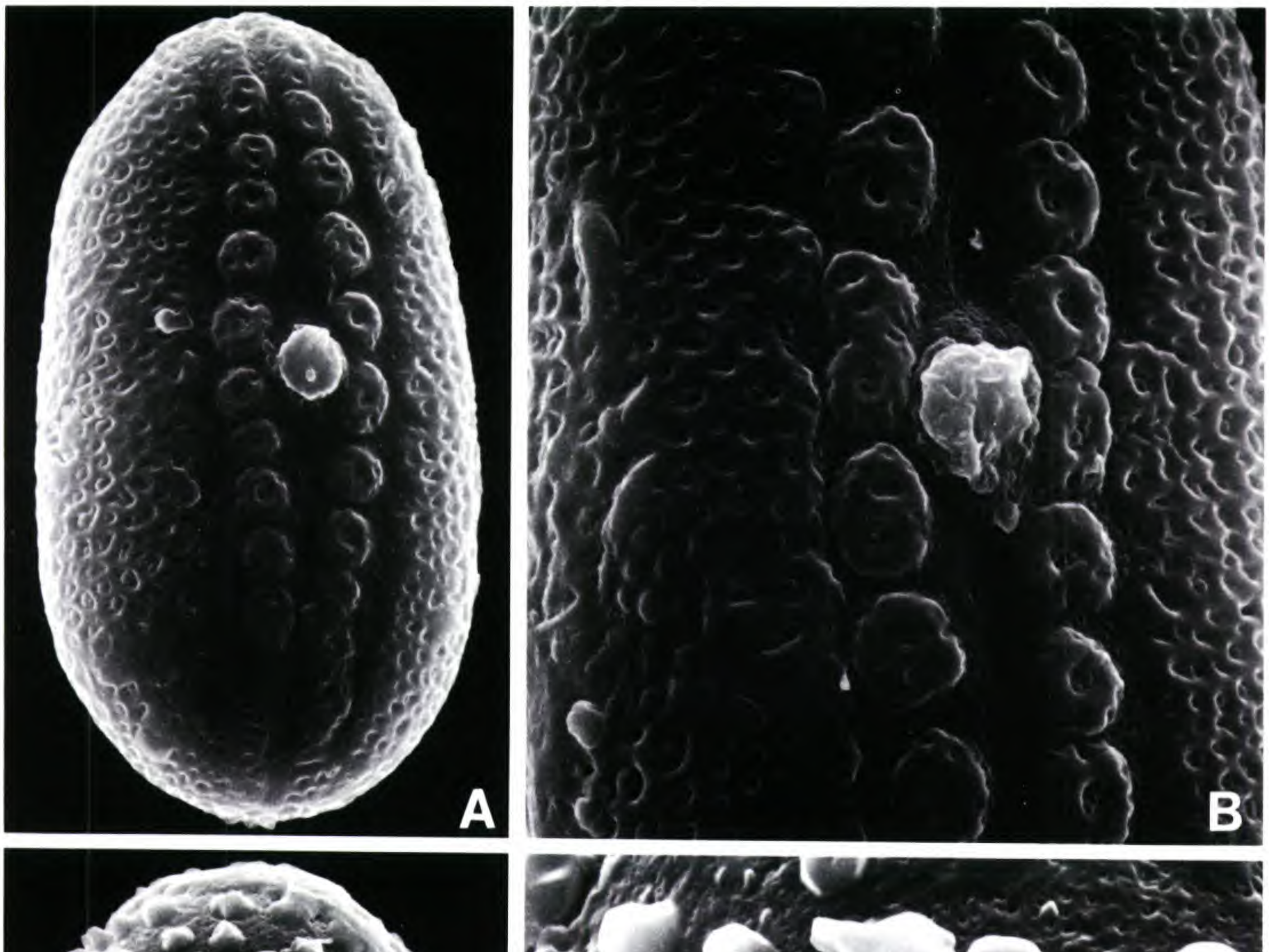

Figure 8. Scanning electron (SEM) photomicrographs of *Justicia* pollen. A, B. *J. panarensis* (*Boom & Grillo 6315*). —A. Equatorial view, ×1,600. —B. Portion of surface, ×3,000. C, D. *J. parimensis* (*Huber & Colchester 8404*). —C. Equatorial view, ×1,600. —D. Portion of surface, ×5,000.

Provincia Napo, Ecuador; however, this species is unique in that the inflorescence is a terminal panicle composed of several unilateral spikes 5–12 cm long (excluding the corollas), the corollas are pale purple or bright rose, 65 mm long, with the subequal lips 37 mm long, and the subequal bracts and bracteoles are lanceolate, 18 mm long, moderately hirsute with the bracteoles slightly longer than the bracts. In contrast, in *J. breteleri* the inflorescence is composed of short, terminal, compact spikes 2–2.5 cm long (excluding the corollas), the corollas are glossy orange, yellow at the base, 50 mm long, with the subequal lips 17–18 mm long, and the bracts and bracteoles are unequal, oblong to oblanceolate, glabrous or inconspicuously puberulous with the bracts 13–15 mm long and the bracteoles 10 mm long, respectively.

11. Justicia parimensis Wasshausen, sp. nov. TYPE: Venezuela. Territorio Federal Amazonas: Depto. Atabapo, Sierra Parima, NE sector, along the Río Matacuni, approx. 20 km NNW of Shimada–Wochi, 3°59′N, 64°41′W, 1,000–1,500 m, 10 Nov. 1983, *Huber & Colchester 8404* (holotype, US). Figure 7A–E.

Suffrutex, caulibus subquadrangularibus, sursum puberulis. Foliorum lamina elliptica vel ovata, acuminata, basi angustata et in petiolum decurrens, firma, utrinque glabra vel parce pilosa; petioli breves; spicae fasciculatae, in aggregis terminalibus paniculam formans, floribus secundis; bracteae et bracteolae triangulares, glabrae et ciliatae; calycis segmenta lanceolata, apiculata, puberula; corolla rosea-lilacina, minute puberula, tubo anguste infundibuliformi, labio superiore erecto, ovato, minute bilobato, labio inferiore oblongo, trilobato, lobis rotundatis; stamina exserta; lobi antherarum superpositi; capsulae clavatae, puberulae, acutae, unumquaeque valve bifida ad apicem.

Shrub or subshrub, erect, 1.5 m tall; stem subquadrangular, glabrous below, becoming puberulous above, the trichomes retrorsely curved, subappressed, arranged ± in two rows. Leaves on short petioles 1–3 cm long, these glabrous or minutely puberulous especially in two rows on the edge of channels, the blades elliptic to ovate, 20–24 cm long, 6.4–8.8 cm wide, acuminate and curved at apex, narrowed at base and decurrent on the petiole, firm, entire, the upper surface drying dark green, glabrous or minutely and inconspicuously pilose, the costa and lateral veins (about 11 pairs) prominent but less so than those of the lower surface, the cystoliths minute and scattered on both surfaces, visible only under a lens, the lower surface drying a lighter green, glabrous or minutely and inconspicuously pilose especially along the venations; inflorescence terminal, the flowers secund in simple spikes, these fascicled, the peduncles 9–12 cm long, the spikes forming in aggregate a loose terminal panicle 15–20 cm long and 5–8 cm wide (without the corollas), the branches of the inflorescence slender, ± angular, puberulous, the trichomes short, erect, sometimes multicellular intermixed with some gland-tipped trichomes; bracts subtending the flowers triangular, barely 2 mm long and 1 mm wide at base, strongly costate, glabrous and ciliolate; bracteoles 1.5 mm long and 0.5 mm wide, in other respects similar to the bracts; calyx 10–13 mm long, light green, the segments narrowly lanceolate, 9–11 mm long, about 1 mm wide at base, minutely apiculate at apex, 3-nerved, puberulous, the trichomes erect, glandular and eglandular; corolla rose-lilac, minutely and inconspicuously puberulous, some of the trichomes gland-tipped, about 45 mm long, the tube 3 mm wide at base, 8 mm wide at the mouth, the upper lip erect, ovate, 20 mm long, 11 mm wide at base, bilobed at the tip, the lobes rotundate, 0.5 mm long and 0.75 mm wide, lower lip somewhat spreading, oblong, 24 mm long and 5 mm wide, trilobate, the lobes rotundate, 2.5 mm long, the middle lobe 2.5 mm wide, the lateral lobes 1 mm wide; stamens exserted, white, curved vertically and exceeding the upper corolla lip, the anther thecae oblique, superposed, the connective 1 mm long and 0.5 mm wide; pollen 2-porate, prolate to perprolate, 51 × 27 μm, trema area not differentiated, the whole surface of grain microreticulate, studded with smooth obtuse-conical verrucae (Fig. 8C, D); capsule clavate, 12 mm long, 4 mm wide, 3.5 mm thick, acute with each valve bifid at apex, puberulous; seeds orbicular, flat, 3 mm wide and long, glabrous.

Distribution. In rocky riverbed, between 1,000 and 1,500 m in Territorio Federal Amazonas, Venezuela. Known only from the type locality.

Justicia parimensis superficially resembles *J. calycina* (Nees) V. A. W. Graham from the Guianas and Venezuela. However, in *J. calycina* the flowers are borne secund, in spikelike racemes, the latter in a large, rather dense terminal panicle, the calyx segments are linear and tapering with a long point, 15–17 mm long, the corolla is brick red, glabrous and 50–60 mm long, and the valves of the capsule are glabrous and entire at apex. In contrast, in *J. parimensis* the flowers are borne in simple spikes, these fascicled, forming in aggregate a loose terminal panicle, the calyx segments are lanceolate, minutely apiculate at apex, 9–11 mm long, the corolla is rose-lilac, puberulous and 45 mm long, and the valves of the capsule are puberulous and bifid at apex.

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New Taxa and Nomenclatural Combinations of Mesoamerican Grasses (Poaceae)

Gerrit Davidse
Missouri Botanical Garden, P.O. Box 299, St. Louis, Missouri 63166, U.S.A.

Richard W. Pohl
Department of Botany, 353 Bessey Hall, Iowa State University,
Ames, Iowa 50011, U.S.A.

ABSTRACT. As a result of a review of the grass family for *Flora Mesoamericana*, 13 new species (*Arthrostylidium judziewiczii*, *A. merostachyoides*, *Aulonemia clarkiae*, *Merostachys latifolia*, *Rhipidocladum martinezii*, *Guadua macclurei*, *Arberella grayumii*, *Cryptochloa soderstromii*, *Pariana argentea*, *Danthonia chiapasensis*, *Pereilema diandrum*, *Digitaria breedlovei*, *D. clavitricha*) and three new varieties (*Eragrostis rufescens* var. *mesoamericana*, *Panicum aquaticum* var. *cartagoense*, *Andropogon gerardii* var. *hondurensis*) are described, one new name (*Elymus cordilleranus*) is proposed, 17 new combinations (*Guadua longifolia*, *Chondrosum hirsutum* var. *glandulosum*, *Dichanthelium sphaerocarpon* var. *floridanum*, *D. sciurotoides*, *D. sciurotis*, *D. aciculare* var. *ramosum*, *D. dichotomum* var. *unciphyllum*, *D. umbonulatum*, *D. cordovense*, *D. pantrichum*, *Paspalidium chapmanii*, *P. distantiflora*, *P. leonis*, *P. pradana*, *P. ophiticola*, *P. subtransiens*, *P. utowanaea*) are made, and one name (*Bromus exaltatus*) is lectotypified.

As a result of writing the account of the grass family for volume 6 of *Flora Mesoamericana*, a number of new taxa were recognized, and the need for several new combinations became apparent. These are published here under the authorship of the person(s) primarily responsible for the account of the taxon. The taxa are arranged in the taxonomic sequence used in *Flora Mesoamericana*, which for a large part follows the scheme of Clayton & Renvoize (1986).

In the bamboo descriptions we refer to the two main types of leaves found in bamboos as the culm leaves and branch leaves. The latter leaf type has been more commonly known in recent years as foliage leaves. However, besides the redundancy implicit in the term foliage leaves, the term branch leaves, in parallel to culm leaves, is more precise in describing the location of these leaves.

BAMBUSEAE: ARTHROSTYLIDIINAE

Arthrostylidium judziewiczii Davidse, sp. nov.
TYPE: Costa Rica. Heredia: primary forest along Río San Rafael, Atlantic slope of Volcán Barva, 10°13′N, 84°05′W, 1,500 m, slender-stemmed, scandent and apparently epiphytic bamboo on mossy trunk of large tree, 3–4 m above ground, 12 Apr. 1986, *M. H. Grayum 7024* (holotype, MO; isotypes, BM, CANB, CR, F, ISC, K, PMA, SI, SP, US).

Bambusa lignosa caespitosa. Culmi cavi ad 4 m longi, 1–2 mm diametro, scandentes; nodis in medio culmi ramos singulares gerentibus. Folia culmorum caduca. Folia ramorum laminis 6–13 cm longis, 1–2 cm latis, glabris. Inflorescentiae bilaterales, spicatae terminales et axillares, terminales 8–14 cm longae; rhachidi recta ca. 1 mm lata, 4–6 spiculas gerenti. Spiculae singulares, 3.5–6.5 cm longae, sessiles; gluma inferna absenti; gluma superna

5.5–6.5 mm longa; flosculo infimo sterili; flosculis fertilibus 5–6, lemmate 8.0–11.5 mm longo, 9-nervi; callo piloso trichomatibus 1.0–1.5 mm longis brunneis, lodiculis 3 ciliolatis, ovario apice puberulento, stylus 1, stigmatibus 2. Fructus non suppetens.

Delicate, caespitose, scandent bamboo to 4 m long. Culms 1–2 mm diam., hollow, cylindrical, smooth, glabrous, the wall ca. ⅓ as thick as the culm diameter; nodal line evident but not expanded, glabrous. Culm leaves (only 2 available from secondary branches) soon stramineous, deciduous; sheaths puberulent at the base and the lower margins; oral setae similar to those of the branch leaves; blades 2.0–2.5 cm long, 3–4 mm wide, lanceolate, reflexed, earlier deciduous than the sheath, narrowed at the base to a pseudopetiole 0.2–0.5 mm long, glabrous, marginally scaberulous in the upper half. Branching intravaginal at the lowermost and uppermost nodes; buds solitary; primary branches at midculm nodes solitary, typically not rebranching at the lower nodes and midculm internodes, sparingly rebranched along their length, rarely with up to 3 branches at the uppermost nodes. Branch leaves 1–6 per complement; sheaths slightly keeled, mostly glabrous, puberulent near the base region and along the overlapping margin; pseudopetiole 1.6–3.0 mm, flattened, glabrous; external ligule a minute rim; internal ligule 0.3–1.5 mm long, a glabrous membrane; oral setae 4.0–9.5 mm long, membranous, whitish; blades 6–13 cm long, 1–2 cm wide, lanceolate, glabrous, basally obtuse, apically acuminate, marginally scaberulous, the midnerve not evident, the lower surface with evident tessellate venation. Inflorescences bilateral, spicate, terminal and axillary from the main leaf complement and sometimes from bladeless secondary branches; terminal spikes 8–14 cm long, with 4–6 spikelets; peduncle glabrous, mostly not exserted from the subtending sheaths; rachis ca. 1 mm wide, straight, glabrous, strongly nerved, sulcate on the side bearing spikelets; axillary spikes similar to the terminal ones but shorter and with fewer spikelets; uppermost 1 or 2 lateral spikelets subtended by solitary or paired glumelike, obtuse, ciliolate bracts to 1 mm long; lowest spikelet sometimes subtended by bracts to 9 mm. Spikelets 3.5–6.5 cm long, sessile, solitary, linear, with 7–9 florets; lower glume absent; upper glume 5.5–6.5 mm, asymmetric, 6-nerved, the midnerve prominently keeled on the back, excurrent as an awn tip 0.2–1.8 mm long, glabrous or ciliolate within the same inflorescence, the outer nerve on the wider portion sometimes slightly keeled, the two keels meeting the edge of the rachis groove; rachilla segments 4–7 mm long, flattened, prominently hispidulous in the upper ¼–¾ with brownish hairs on the side opposite the subtending lemma; lowest floret sterile, the lemma 9-nerved, abaxially tessellate-nerved, the midnerve prominent, excurrent as an awn tip 0.5–1.3 mm long, a palea absent or to ½ as long as and much narrower than the lemma, the callus glabrous; fertile, bisexual florets 5–6, the lemma 8.0–11.5 mm, 9-nerved with the midnerve excurrent as an awn point 0.5–2.0 mm long, glabrous, marginally scaberulous in the upper ⅓, the callus prominently appressed pilose with hairs 1.0–1.5 mm long, the hairs initially white, turning brown, the palea nearly as long as the lemma, membranous, 2-nerved, 2-keeled, the keels ciliolate; uppermost 1–2 florets smaller, without flowers; lodicules 3, membranous, lanceolate, ca. 3–3.5 mm long, forming a tube around the pistil, ciliolate at apex, sparsely nerved; ovary with a puberulent apex; stamens 3, the anthers 3.8–5.1 mm long, yellow; style 1; stigmas 2, long-plumose. Fruit not available.

Paratype. PANAMA. BOCAS DEL TORO: along trail back to Boquete, in cloud forest, scandent, no larger culms seen, 6,000 ft., 13 Feb. 1979, *Hammel 6173* (MO).

Although the type collection was apparently epiphytic (M. H. Grayum, pers. comm.), this was probably an isolated instance as happens sporadically and accidently with other grasses when their seeds happen to land on tree trunks and in branch crotches with a large accumulation of epiphytic plant debris.

Just as at the lowermost and uppermost nodes, the branching at midculm nodes is probably also intravaginal, despite the fact that the mostly solitary branches are predominantly divergent at the base as in many other scandent bamboos. This habit with widely spreading branches is doubtlessly important in enabling these plants to climb into supporting vegetation. Young culms with culm leaves are not among the available collections, but it appears that the culm leaves are quickly pushed away by the expanding branch.

Arthrostylidium judziewiczii has three unusual characters, one of which makes placement within *Arthrostylidium* Rupr. somewhat problematical.

First, the prominently pilose callus is unusual. The only other species with hair on the callus is *A. ecuadorense* Judz. & L. G. Clark, but in this species it is much less prominent.

Second, unusual in the genus is the production of one branch per node that is not rebranched at its basal nodes. However, at one midculm internode of *Grayum 7024* (MO), the primary branch was immediately branched at the base. Furthermore, at occasional nodes near the apex of the culm, the primary branch may also be branched immediately, thereby producing a complement of up to four lateral

branches. The occurrence of occasional basal branching is judged to be an indication of fundamental similarity to the typical branching pattern in the genus. Among New World bamboos, basally unbranched primary branches are characteristic of *Olmeca* Soderstrom, *Myriocladus* Swallen, and most species of *Aulonemia* Goudot. All these genera have panicles in contrast to the unbranched spikes or racemes in *Arthrostylidium* (except *A. merostachyoides* with a highly reduced panicle, see below). *Myriocladus* is a totally distinct endemic genus from the Guayana Highlands. *Olmeca* has fleshy fruits, erect culm blades, and sympodial rhizomes. *Aulonemia* species usually have articulated, reflexed blades, and in this regard *A. judziewiczii* appears to be similar. However, only culm leaves from secondary branches with moderately developed blades were available for study, and it is not certain that these have the same morphology as typical culm leaves from lower to midculm nodes from the main culm. The evidence therefore remains inconclusive. The spike of *A. judziewiczii* is quite similar to that of most species of *Arthrostylidium*, although most species differ in having subsessile spikelets with a small but evident pedicel, thus making the inflorescence a spikelike raceme.

Third, also unusual is the occasional production of small glumelike bracts at the base of the spikelets, which, although very small, clearly embrace both the spikelet base and part of the rachis. These are therefore homologous to subtending leaves, and the inflorescences are bracteate spikes. Furthermore, this is one of the transitional stages postulated for the origin of normal grass spikelets from pseudospikelets as hypothesized by McClure (1934, 1966). Additional comments on this topic will be presented in a separate paper.

The specific epithet honors the outstanding contributions to agrostology of Emmet J. Judziewicz, especially his contributions to our knowledge of bamboos.

Arthrostylidium merostachyoides R. Pohl, sp. nov. TYPE: Costa Rica. Puntarenas: Monteverde, 4 Jan. 1985, *R. W. Pohl & L. G. Clark 14613* (holotype, ISC; isotypes, CR, F, K, MO, US). Figure 1.

Merostachys glabra R. Pohl, nom. nud.

Bambusa lignosa caespitosa. Culmi cavi ad 10 m longi et ad 1.5 cm diametro; nodis in medio culmi ramos 7–40 gerentibus. Folia culmorum glabra; vaginis persistentibus; laminis erectis, deciduis vel persistentibus. Folia ramorum laminis 4–17 cm longis, 1.0–2.6 cm latis, adaxialiter glabris, abaxialiter pubescentibus secus marginem unicum. Inflorescentia unilateralis spicata, terminalis, 2.5–8.0 cm longa; rhachidi recta, 1.5–2.0 mm lata, spiculas numerosas gerenti. Spiculae plerumque geminatae, 9.5–14.0 mm longae, subsessiles, glabrae, supra lemma sterile discedentes; gluma inferna 0.1–2.5 mm longa; gluma superna 2.0–3.5 mm longa; flosculo infimo sterili, 3.5–5.0 mm longo; flosculis fertilibus 2–3, lemmate 6.2–8.2 mm longo, 5–7-nervi, lodiculis 3, glabris, antheris 3, 3.2–4.2 mm longis; ovario glabro, stylo 1, stigmatibus 2. Fructus non suppetens.

Caespitose, ligneous bamboo. Rhizomes pachymorph. Culms 5–10 m long, 1.0–1.5 cm diam., arching, hollow, cylindrical, glabrous, yellow. Culm leaves with the sheaths and blades glabrous; sheaths persistent; blades soon deciduous or persistent in older, larger culms, erect, tapering from the base to the acuminate apex, longer than the sheaths, lacking auricles; external ligule not evident; internal ligule ca. 0.5 mm long, a stiff, minutely ciliolate membrane. Midculm branch complement arising from a distinct promontory, this ± truncate at the apex; branches 7–40 per node, to 30 cm long, some rebranched. Branch leaves 4–7 per complement, the lower blades deciduous; sheaths truncate, puberulent on the overlapping margin, bearing stiff auricular bristles 7–16 mm long; pseudopetioles 1.5–2.5 mm long, flattened, puberulent abaxially; internal ligule 0.5–0.6 mm, a ciliolate membrane; blades 4–17 cm long, 1.0–2.6 cm wide, lanceolate-ovate, pendent, flat, rounded to an asymmetric base, acuminate, glabrous above, pubescent along one margin below. Inflorescences 2.5–8.0 cm long, unilateral, reduced racemelike panicles, terminal on leafy or sometimes bladeless branches; rachis 1.5–2 mm wide, obtusely angular, narrowly grooved above the point of spikelet insertion, glabrous. Spikelets 9.5–14 mm long, usually paired, pectinate in 4 rows along one side of the rachis, sometimes solitary in 2 rows, especially toward the tip of the raceme, laterally compressed, with 4 or 5 florets, subsessile, the pedicels 0.4–1.4 mm long; lower glume 0.1–2.5 mm long, 1–3-nerved; upper glume 2.0–3.5 mm long, 3–5-nerved; lowest floret sterile, the lemma 3.5–5.0 mm long, 3–7-nerved; disarticulation above the sterile floret and between the fertile florets; fertile, bisexual florets 2–3, the lemmas 6.2–8.2 mm long, keeled, 5–7-nerved, acute, awnless, the palea subequal to the lemma; terminal sterile floret as long as the fertile florets; lodicules 3, ovate, flat, vasculated, eciliate; stamens 3, the anthers 3.2–4.2 mm long; ovary glabrous; style 1, slightly thickened at the base; stigmas 2. Fruit not available.

Paratypes. COSTA RICA. ALAJUELA: 17–20 km NNW of San Ramón, 10°13′N, 84°32′W, 24 Apr. 1983, *Liesner & Judziewicz 14771* (MO). GUANACASTE: Parque Rincón de la Vieja, 10°46′N, 85°49′W, 2 Dec. 1987,

Herrera 1488 (MO). LIMÓN: Cantón de Limón, cabeceras de Río Cariei, 09°47′20″N, 83°08′18″W, 26 Apr. 1989, *Herrera & Chacón 2801* (MO). PUNTARENAS: Monteverde Forest Reserve, Cordillera de Tilarán, Dec. 1977, *Dryer 1708* (ISC, MO), 12 Apr. 1983, *Judziewicz 4628* (MO, WIS), 24 Aug. 1985, *Haber 2414* (MO), *2415* (MO), *2416* (CR, EAP, ISC, L, MEXU, MO, PMA, SI, US), 27 Aug. 1985, *Haber & Bello 2481* (MO), 12 Feb. 1985, *Grayum et al. 5126* (CR, INPA, ISC, K, MO, US), 4 Jan. 1985, *Pohl & Clark 14611* (ISC, MO).

Arthrostylidium merostachyoides is presently known from cloud forests at elevations from 750 to 1,850 m in the Cordillera de Tilarán, Cordillera de Guanacaste, and one locality of the Atlantic slope of the Cordillera de Talamanca. This distribution suggests that it may also eventually be found in Panama.

Seedlings were abundant on road embankments and cliffs at the type locality in the Monteverde Nature Reserve. Some had reached 1 m height and had short rhizomes. They evidently grew from seeds produced in previous seasons.

Although this species clearly belongs to the Arthrostylidiinae Soderstrom & Ellis (1987), its generic disposition is less certain, a point also discussed by Clark & Londoño (1991). The inflorescence structure is unique in *Arthrostylidium* and initially caused us to consider this a species of *Merostachys* Sprengel. The epithet refers to this similarity. However, *A. merostachyoides* possesses none of the other diagnostic characters traditionally (McClure, 1973) ascribed to *Merostachys*. Specifically, its culm blades are broad at the base and appressed to the culm (vs. narrow, shortly pseudopetiolate and reflexed); the midculm branching complement arises from a truncate promontory (not a triangular plate); the spikelets have a developed lower glume (vs. absent or reduced to a rim); and the palea keels are widely spaced and do not tightly enclose a long rachilla internode with a spikelet rudiment.

The strongly secund inflorescence resembles that of some *Merostachys* species in which the spikelets are paired on each side of the rachis. However, the grooves in the rachis above each point of spikelet insertion are much narrower in *A. merostachyoides* than in *Merostachys* species, and the raceme, therefore, appears less flattened on the spikelet-bearing side. In contrast, all previously described *Arthrostylidium* species have bilateral spikes or racemes, some of which are strongly zigzagged. Nevertheless, the preponderance of diagnostic characters favors a disposition outside of *Merostachys*.

Arthrostylidium and *Rhipidocladum* McClure are very closely related but are distinguished primarily by their midculm branch complements, which arise from a triangular plate in *Rhipidocladum*. The inflorescence type of *A. merostachyoides* is very similar to that of *Rhipidocladum geminatum* (McClure) McClure, but the species seems otherwise not closely related. *Rhipidocladum* as currently circumscribed has three other inflorescence types, including a zigzag raceme more common among *Arthrostylidium* species (McClure, 1973; Clark & Londoño, 1991).

It should also be noted that only the collections from the Monteverde area show predominantly paired spikelets on each side of the rachis, although toward the tip there is often only one spikelet per node. However, even in these collections, some of the smaller inflorescences borne on leafless branches may only have one spikelet per node on each side of the rachis. Such inflorescences with solitary spikelets at the rachis nodes are nearly identical to those of *Rhipidocladum maxonii* (A. Hitchc.) McClure in organization, but are much larger.

In contrast, in *Herrera & Chacón 2801* and *Herrera 1488* all inflorescences bear one spikelet per node on each side of the rachis. In occasional inflorescences the lowest node of the inflorescence bears an elongated branch with up to eight spikelets. Since the pedicels of "typical" spikelet pairs in plants from the Monteverde region are of slightly different length, we interpret these to represent very reduced branches and the inflorescence, therefore, to represent a reduced secund panicle. Control of inflorescence development is evidently not stabilized in this species.

We agree with Clark & Londoño (1991) that it is likely that some characters traditionally employed to define genera in the Arthrostylidiinae, especially inflorescence type, may have evolved independently several times in this subtribe and that generic delimitations must be reconsidered.

Aulonemia clarkiae Davidse & R. Pohl, sp. nov. TYPE: Mexico. Chiapas: Municipio Jitotol, 5 km SE of Jitotol along road to Bochil, in trees, open forest with *Pinus*, *Quercus*, *Nyssa*, *Liquidambar*, and *Brunellia*, culms to 8 m tall, 1,600 m, 8 Nov. 1981, *D. E. Breedlove & G. Davidse 55085* (holotype, MO; isotypes, CAS, US). Figure 2.

Bambusa lignosa rhizomatibus 10–30 cm longis et 6–15 mm crassis. Culmi 5–8 m longi, 1.0–1.6 cm diametro; nodis in medio culmi ramos singulares gerentibus. Folia culmorum vaginis persistentibus; setis oralibus abundantibus et prominentibus; laminis reflexis, cauducis. Folia ramorum laminis 10–36 cm longis, 9–15 mm latis, adaxialiter scabris, abaxialiter puberulis. Inflorescentia paniculata, terminalis, 10–33 cm longa. Spiculae 19–25 mm longae; gluma inferna 3–5 mm longa arista 2.0–5.5 mm longa munita; gluma superna 5.0–7.2 mm longa arista

Figure 1. *Arthrostylidium merostachyoides* R. Pohl. —A. Young culm with culm leaves, the blades erect. —B. Flowering midculm branch complement. —C. Enlargement of a midculm branch complement showing the conspicuous promontory. —D. Rachis segment with two pairs of spikelets. —E. Spikelet. (A, B based on *Pohl & Clark 14613;* C based on *Pohl & Clark 14612;* D, E based on *Haber 2414.*)

2.5–4.5 mm longa munita; flosculis 2; flosculo inferno plerumque sterili interdum fertili, 9.5–10.5 mm longo arista 3.0–5.5 mm longa munito; flosculo superno fertili lemmate 13–15 mm longo, indimidio superiore pubescenti arista 4–5 mm longa munito, lodiculis 3, ciliatis, antheris 3, 8.5–9.0 mm longis, ovario glabro, stigmatibus 2; rhachilla ultra flosculum terminalem producta. Fructus non suppetens.

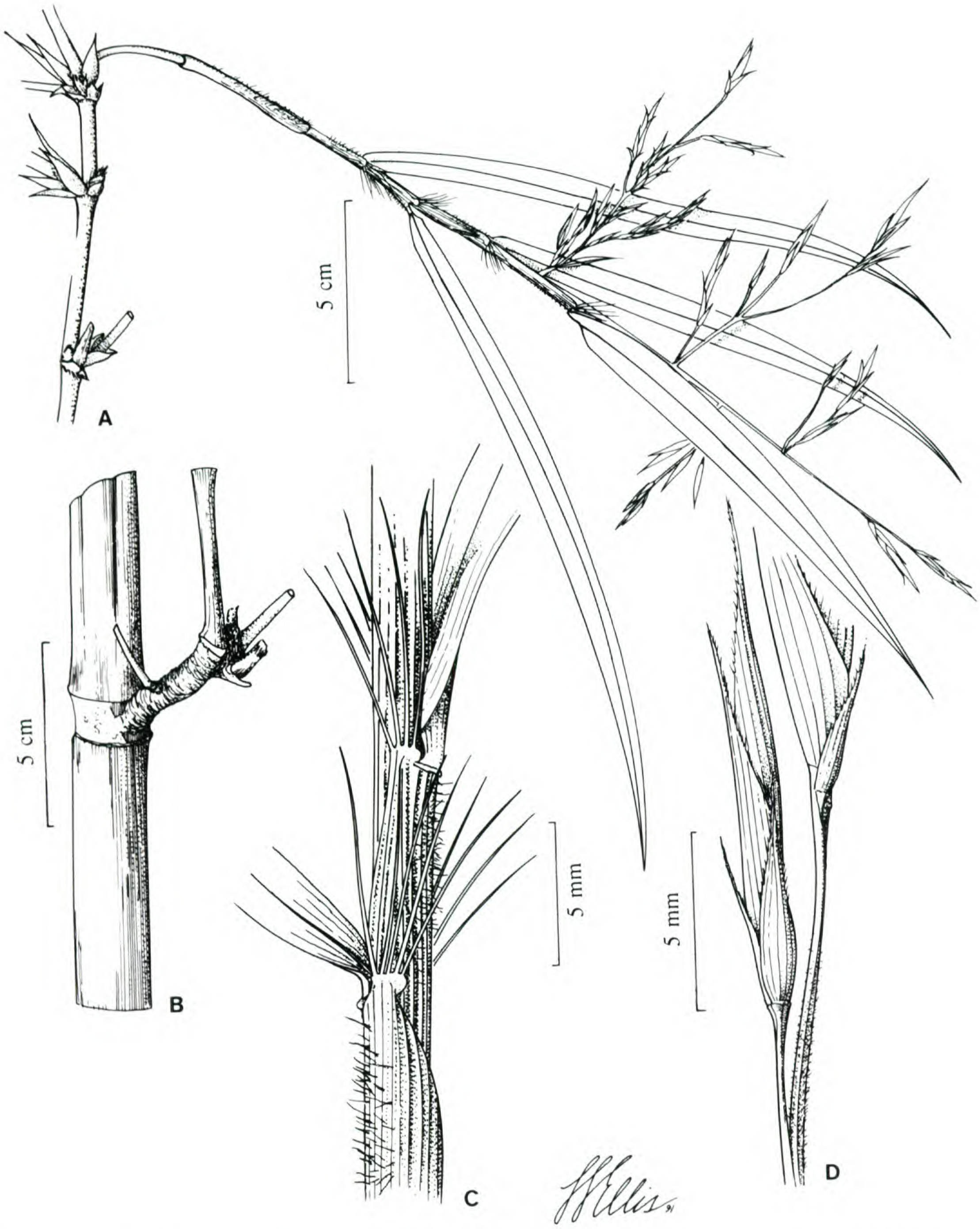

Figure 2. *Aulonemia clarkiae* Davidse & R. Pohl. —A. Flowering branch complement. —B. Midculm nodal complex with a single primary branch. —C. Ligular region of two branch leaves showing the prominent oral setae. —D. Spikelet. (A, C, D based on *Breedlove 58512*; B based on *Breedlove & Davidse 55085*.)

Caespitose, ligneous bamboo. Rhizomes 10–30 cm long, 6–15 mm thick, densely covered by scale leaves. Culms 5–8 m long, 1.0–1.6 cm diam., erect, solitary, hollow, cylindrical, glabrous, green, with thin walls, the upper portion pendent, producing branches in the upper ¾. Culm leaves with long-persistent, stramineous, glabrous to papillose-pilose sheaths; auricles not developed; oral setae well-developed, 8–15 mm long, the central ones flattened at the base and borne on the back of the ligule, the

marginal ones cylindrical at the base and borne on the sheath apex; external ligule a minute rim; internal ligule a membrane 0.8–2.0 mm long, glabrous; blades reflexed to spreading, soon deciduous, narrower than the apex of the sheath, ciliolate. Branches intravaginal, 1 per node, the primary branches usually rebranching once or the larger midculm primary branches forming a fascicle of branches at the base. Branch leaves 4–8 per complement; sheaths of the lower leaves of a complement usually prominently papillose-hirsute with reddish brown, divergent hairs 1.5–3.0 mm long, ciliate with finer hairs on the margins, the upper sheaths of a complement puberulent or glabrous; external ligule a rim 0.1–0.2 mm long, sometimes irregular and to 0.8 mm long at the margin of the pseudopetiole; internal ligule a membrane 0.5–1.0 mm long, minutely ciliolate; auricles to 1 mm long on one side, poorly or not developed or absent on the other side; oral setae 7–15 mm long, prominent on each side of the pseudopetiole; pseudopetiole hardly differentiated; blades 10–36 cm long, 9–15 mm wide, linear-lanceolate, basally attenuate, apically long-attenuate, retrorsely scabrid above, puberulent and weakly tessellate below. Inflorescence a panicle 10–33 cm long, terminal on leafy branches; peduncle not exserted; rachis ± triangular, puberulent and/or scabrous; primary branches to 15 cm long, solitary, widely divergent at maturity, prominently pulvinate, the pulvini swollen, brown, puberulent, the lowermost branch often subtended by a small bract; secondary branches few, primarily in the lower part of the panicle, pulvinate and divergent; pedicels glabrous, appressed to the panicle branches, the lateral ones 2–8 mm long. Spikelets 19–25 mm long, linear-lanceolate, 2-flowered with a prominent rachilla extension beyond the terminal floret; disarticulation above the glumes and between the florets; glumes 2, unequal, shortly awned, marginally ciliate in the upper ½, the lower 3–5 mm long, 3-nerved, lanceolate, the awn 2.0–5.5 mm long, the upper 5.0–7.2 mm long, 5–7-nerved, lanceolate, the awn 2.5–4.5 mm long; lower floret usually sterile, rarely fertile and then similar to the upper floret; lower lemma 9.5–10.5 mm long, 11–13-nerved, marginally ciliate on the upper ½, glabrous on the back, awned, the awn 3.0–5.5 mm long; lower palea usually 1.5–2.0 mm long, pubescent, subtending a rudimentary bisexual flower with stamens to 0.5 mm long and a minute pistil, rarely fully developed and similar to the upper palea and subtending a fully developed bisexual flower; rachilla internode between the florets 2.5–6.0 mm long, thickened upward, puberulent; upper floret bisexual; upper lemma 13–15 mm long, 11–13-nerved, tessellate-nerved in the upper ¾, marginally ciliate in the upper ½, puberulent on the back and/or on the sides in the upper ½ and with the base shortly appressed-pubescent, awned, the awn 4–5 mm long; upper palea as long as the lemma, 4-nerved, 2-keeled and narrowly grooved between the keels, puberulent between and on the keels, glabrous or pubescent in the upper ½ on the sides; rachilla extension 9.0–12.5 mm long, tightly held in the groove between the keels, without or with a minute, undifferentiated rudimentary floret 0.1–0.2 mm long, puberulent in the upper half and thickened toward the apex; lodicules 3, the 2 anterior ones 2.0–2.5 mm long, lanceolate, flat, slightly thicker at the base, ciliate in the upper ½, obscurely nerved, the posterior one slightly smaller; stamens 3, the anthers 8.5–9.5 mm long; ovary cylindrical-fusiform, glabrous; stigmas 2. Fruit not available.

Paratypes. MEXICO. CHIAPAS: Municipio of Jitotol, 5 km SE of Jitotol along road to Bochil, open forest with *Pinus*, *Quercus*, *Nyssa*, *Liquidambar*, and *Brunellia*, 1,600 m, 9 Jan. 1981, *Breedlove & Keller 49359* (CAS), 10 Sep. 1981, *Breedlove 52658* (CAS, MO), 24 Feb. 1982, *Breedlove 5812* (CAS, MO, US).

This species is definitely known only from a single population in Chiapas, Mexico. It was first observed by Dennis E. Breedlove of the California Academy of Sciences, who discovered it coming into flower and who observed and collected it intermittently over a period of 16 months. Davidse revisited the locality in November 1984 and could not find a trace of the plants, neither adult plants nor seedlings, from which we tentatively conclude that this population died after flowering synchronously and did not produce viable seed.

This species was briefly discussed by Soderstrom (1988) when he described *Aulonemia fulgor* Soderstrom from Oaxaca. Soderstrom (pers. comm.) believed it to be a closely related, undescribed species, but his untimely death prevented him from pursuing his study of these collections to completion.

Aulonemia clarkiae differs from *A. fulgor* in its thicker and longer rhizomes, and, consequently, more diffuse spacing of the culms; taller (5–8 m vs. 5–6 m) and wider (1.0–1.6 cm vs. 0.5–1.0 cm), more strictly erect culms; puberulent versus glabrous lower leaf surfaces; usually sterile versus always fertile lower floret; pubescent versus glabrous upper lemma; and longer (8.5–9.5 mm vs. 6.0–7.0 mm) anthers.

Soderstrom (1988: 29, fig. 2) discussed and illustrated the rhizome system of the type collection of *A. fulgor* in detail. However, as noted by him, the description applies primarily to those decumbent culms that root at the nodes and may at times form

rhizomes. At Soderstrom's request, Davidse restudied the main rhizome system of *A. fulgor* in the field (*Davidse et al. 30258*) and found, as had been supposed by Soderstrom, that it is a sympodial system. In *A. fulgor* the slender, pachymorph rhizomes are generally 4–7 cm long before they turn upward to produce a new culm. Well-developed plants produce 20–30 loosely clumped culms. Those toward the outside of the clump tend to be more decumbent and more often root at the lower nodes. Although the basic rhizome system is similar in *A. clarkiae*, the rhizomes are much longer and thicker, and thus the culms are widely spaced and not truly clump-forming.

Soderstrom (1988: 30) characterized the plants that we are naming *A. clarkiae* as having three glumes and also noted that *Aulonemia*, sensu McClure (1973), has species with two or three glumes. The species pair here discussed clearly demonstrates that it is better to interpret the so-called three-glumed species as having two glumes and a sterile lemma in which the enclosed palea and flower have been totally lost through reduction. This becomes apparent from the following comparison. In *A. fulgor* all spikelets have two fully developed florets above the two glumes (Soderstrom, 1988). In contrast, in *A. clarkiae* two fully developed florets are rare. Much more common are two florets in which only the upper one is fully developed and in which the lower one usually has a fully developed lemma subtending a rudimentary palea and flower. By homology, other species of *Aulonemia* with a third empty bract represent a further step in this reduction series, namely, one in which the lowermost floret has been consistently reduced to a lemma.

For the reasons enumerated by Soderstrom (1988) we follow him in tentatively classifying this species in *Aulonemia*, even though the genus, as circumscribed by McClure (1973) and accepted by Calderón & Soderstrom (1980), is probably heterogeneous and is likely to be polyphyletic. As one of the discordant elements in a widely circumscribed *Aulonemia*, the *A. fulgor–A. clarkiae* species pair may deserve to be segregated as a distinct genus. It is another example of the need for an overall reassessment of generic classification mentioned in the discussion of *Arthrostylidium merostachyoides*.

The species is named for Lynn G. Clark, Iowa State University, in recognition of her outstanding contributions to agrostology, especially bamboos and *Chusquea* in particular.

The bamboo genus *Merostachys* is closely related to *Rhipidocladum*, both genera having branch complements arising from a triangular, flat, adnate meristem in a fan-shaped array. They are conventionally distinguished by the reflexed culm blade in *Merostachys* and the erect blade in *Rhipidocladum* (McClure, 1973). While this structure is not known for the species described below, from the form of the inflorescences and nature of the spikelets, it is clearly a new species of *Merostachys*.

Merostachys latifolia R. Pohl, sp. nov. TYPE: Nicaragua. Jinotega: *W. D. Stevens & J. Henrich 20418* (holotype, ISC; isotypes, BM, CAS, COL, CR, EAP, F, HNMN, K, L, MEXU, MO, NY, PMA, RB, SI, SP, US, VEN). Figure 3.

Bambusa lignosa caespitosa. Culmi 1.5–4 m longi, ad 8 mm diametro; nodis in medio culmi ramos ad 10 gerentibus. Folia culmorum ignota. Folia ramorum in complemento 2–6, laminis 15–20 cm longis, 2.8–4.9 cm latis, ovatis. Inflorescentia unilateralis, spicata, terminalis, 5–7 cm longa; rhachidi arcuata, ca. 1 mm lata, velutina. Spiculae singulares vel geminatae, falcatae, 10–13 mm longae; gluma inferna absenti; gluma superna 1.5–3.5 mm longa; flosculo inferno sterili, 4.7–7.0 mm longo ex lemmate 7-nervi tantum constanti; flosculo superno fertilii lemmate 9–10 mm mutico; palea superna anguste sulcata inter carinas; rhachilla ultra flosculum terminale per 6.5–10.0 mm producta, in flosculum abortivum minutum terminanti. Flosculi sub anthesi etiam fructus non suppententes.

Caespitose, ligneous bamboo. Rhizomes pachymorph. Culms 1.5–4.0 m long, to 8 mm diam., hollow, cylindrical, mottled with purple, asperous below the nodes; nodes retrorsely bearded. Culm leaves not known. Branches to 10 per node, to 45 cm long, including the inflorescence. Branch leaves 2–6 per complement; sheaths glabrous to puberulent; auricular bristles prominent, 10–15 mm long, also borne for several mm along the uppermost portion of the overlapping sheath margin; internal ligule 0.1–0.6 mm long, ciliolate; pseudopetiole 6–10 mm long, flattened; blades 15–20 cm long, 2.8–4.9 cm wide, ovate, flat, dark green, glabrous but scabrid along one margin on the upper surface. Inflorescences 5–7 cm long, spikelike, terminal on leafy and bladeless lateral branches, slightly arcuate; rachis ca. 1 mm wide, densely velutinous. Spikelets 10–13 mm long, diverging from the rachis, solitary or paired, slightly falcate, slightly laterally compressed; lower glume absent; upper glume 1.5–3.5 mm long, triangular, 1-nerved; lower floret sterile, consisting only of a lemma 4.7–7.0 mm long, glabrous, 7-nerved; upper floret fertile, bisexual; upper lemma 9.0–10.0 mm long, 11-nerved, awnless, sparsely puberulent or shortly pubescent; upper palea 9.2–10.5 mm long, slightly longer than the lemma, narrowly grooved between the keels and tightly clasping the slender rachilla extension; rach-

Figure 3. *Merostachys latifolia* R. Pohl. —A. Flowering midculm branch complement. —B. Rachis segment with two spikelet pairs. —C. Fertile floret with rachilla extension bearing a minute rudimentary floret. (Based on *Moreno 16367*.)

illa extension 6.5–10.0 mm long, bristlelike, tipped with a minute rudimentary floret. Flowers and fruit not available.

Paratypes. HONDURAS. OLANCHO: Finca Santa Rosita, a 5 km al S del Campamento, 1 June 1985, *Téllez V. & Martínez S. 8507* (MO). NICARAGUA. MATAGALPA: NW slope of Cerro El Picacho, ca. 13°00′N, 85°55′W, 25 May 1983, *Stevens & Moreno 22117* (CR, HNMN, ISC, MO, US). JINOTEGA: km 146 carretera Matagalpa–Jinotega, 13°02′N, 85°56′W, 16 May 1982, *Moreno 16367* (HNMN, MO, US). COSTA RICA. PUNTARENAS: Zapotel, Montes de Oro, May 1961, *Jiménez s.n.* (F, ISC, MO). ALAJUELA: La Palma de San Ramón, 17 Apr. 1927, *Brenes 5433* (F).

Additional sterile collections. GUATEMALA. EL PROGRESO: Montaña Canahui, between Finca San Miguel and summit of mountain, near upper limits of Finca Caieta, 10 Feb. 1942, *Steyermark 43772* (F). NICARAGUA. JINOTEGA: along Hwy. 3 from Jinotega to Matagalpa, ca. 5–8 mi. SW of Jinotega, 7 Aug. 1977, *Croat 43057* (MO). PANAMA. COCLÉ: El Valle, 17 Jan. 1973, *Soderstrom 2011* (MO). DARIÉN: along ascent of Serranía de Pirre, above Cana Gold Mine, between Río Cana and Río Escucha Ruida, 27 July 1976, *Croat 37779* (MO).

This species grows in the understory of cloud forests at 1,100–2,300 m. The type collection and all the paratypes are post-anthesis specimens. The cited sterile collections are also tentatively identified as this species, but we await the collection of fertile specimens from these areas for confirmation. Other sterile collections of *Merostachys*, in addition to the cited ones, are known from Mesoamerica, but they probably represent other species and are too fragmentary for positive identification.

This is the species described by McClure in Swallen (1955: 207) under the name *M. argyronema* Lindman (1900). This Brazilian species differs in having branch leaf blades 9–12 (not 15–20) cm long and 1.2–1.6 (not 2.8–4.9) cm wide, up to 29 (not to 10) branches at the midculm nodes, 7–8 (not 2–6) branch leaves per complement, solitary (not paired) spikelets, and lower lemma 5-nerved (not 7-nerved). Lindman did not indicate either in his description or illustration the presence of the prominent elongated rachilla internode clasped by the palea in spikelets of *M. latifolia*, but this is characteristic of every known species in the genus.

The genus is primarily Brazilian with more than 30 species, including a number of undescribed ones. Among the broad-bladed species with strongly unilateral racemes with primarily paired spikelets, *M. latifolia* resembles *M. riedeliana* Rupr. but has much shorter spikelets (10–13 vs. ca. 18 mm), and shorter, acute sterile lemmas (4.7–7.0 vs. 12–14 mm and short-awned). However, the genus is so little understood that it is difficult to assess relationships.

Rhipidocladum martinezii Davidse & R. Pohl, sp. nov. TYPE: Mexico. Chiapas: Mun. Unión Juárez, en el volcán Tacaná, a 5 km al S de Talquián, 1,550–1,700 m, bosque mesófilo de montaña, arbusto voluble, flor amarilla con estambres morados y fruto, 8 Feb. 1987, *E. Martínez S., A. Márquez, G. Urquijo & M. Ramírez 19767* (holotype, MO; isotype, MEXU). Figure 4.

Bambusa lignosa caespitosa. Culmi 8–16 mm diametro; nodis in medio culmi ramos 100–200 gerentibus. Folia culmorum ignotae. Folia ramorum laminis 4–8 cm longis, 2.5–3.5 mm latis. Inflorescentia unilateralis racemosa, terminalis, 2–4 cm longa, glabra, spiculas 2–4 gerens. Spiculae 25–30 mm longae; gluma inferna 2.5–7.0 mm longa arista 2–3 mm longa munita; gluma superna 6–11 mm longa arista 2.5–3.5 mm longa munita; flosculo infimo sterili, lemmate 12–15 mm longo, arista 3–5 mm longa; flosculis fertilibus 2–4, lemmate 12–19 mm longo, scaberulo, arista 3–6 mm longa, lodiculis 3, glabris, antheris 3, 6–7 mm longis, stylo 1, stigmatibus 2. Caryopsis 5.5–6.1 mm longa, 1.0–1.2 mm lata; hilo caryopside aequilongo.

Caespitose, ligneous bamboo. Rhizome pachymorph. Culm length unknown; internodes 8–16 mm diam., relatively thin-walled, hollow, cylindrical, glabrous. Culm leaves unknown. Primary branch element flat, triangular, adnate to the main culm, bearing 100–200 flowering branches at midculm nodes; flowering branches 10–30 cm long, glabrous, leafy or leafless toward the tips of the main culm, branched or unbranched, thin and delicate, the leafless branches mostly 4–5 cm long, bearing 2–4 spikelets. Branch leaves 2–5 per complement; sheaths glabrous, truncate; oral setae 1.5–2.5 mm long, flexuous; external ligule a rim; internal ligule 0.1–0.3 mm long, membranous, ciliolate; pseudopetiole 1.0–1.3 mm long, 0.2–0.3 mm wide, glabrous; blades 4–8 cm long, 2.5–3.5 mm wide, linear-lanceolate, flat, sparsely puberulent at the base below, often scaberulous near one margin above, otherwise glabrous. Inflorescence a solitary, unilateral raceme bearing 2–4 spikelets; peduncle scarcely exserted, puberulent; rachis 2–4 cm long, glabrous, the internodes 8–15 mm long; pedicels to 0.5 mm long, appressed. Spikelets 25–30 mm long, appressed, disarticulating above the lowest, sterile floret and between the 2–4 fertile, bisexual florets; florets 4–7, the lowest sterile, the uppermost 1 or 2 staminate or sterile, the terminal one usually rudimentary; lower glume sometimes lacking entirely in terminal spikelets, when present usually 2.5–7.0 mm long including a 2–3-mm-long awn, narrowly lanceolate, 1-nerved; upper glume 6–11 mm long including a 2.5–3.5-mm-long awn, lanceolate, 5–7-nerved, glabrous; rachilla internodes 2.7–4.5 mm long, glabrous; lower floret re-

Figure 4. *Rhipidocladum martinezii* Davidse & R. Pohl. —A. Leafy flowering midculm branch complement. —B. Leafless, flowering branch complement. —C. Spikelet. (A based on *Martínez et al. 20286;* B, C based on *Martínez et al. 19767.*)

duced to a lemma 12–15 mm long including a 3–5-mm-long awn, lanceolate, 7–9-nerved, scaberulous on the upper ⅔; fertile lemmas 12–19 mm long including a 3–6-mm-long awn, lanceolate, attenuate, 7–9-nerved, scaberulous in the upper ⅔; fertile paleas 9.5–10 mm long, as long as or distinctly shorter than the fertile lemmas, 4–6-nerved, 2-keeled, ciliolate in the upper ⅓ on the keels; callus knoblike; lodicules 3, the two posterior ca. 2 mm long, flat, somewhat thickened at the base, lanceolate but with one side straight, glabrous, the upper margin sparsely ciliolate, the anterior one narrower, linear; stamens 3, the anthers 6–7 mm long; style 1; stigmas 2; ovary linear-lanceolate. Caryopsis 5.5–6.1 mm long, 1.0–1.2 mm wide, flattened and slightly grooved on the hilar side, rounded on the embryo side, dark brown; embryo ca. 1 mm long; hilum as long as the caryopsis.

Paratypes. MEXICO. CHIAPAS: Mun. Unión Juárez, Volcán Tacaná, 5 km al S de Talquián, 8 Feb. 1987, *Martínez et al. 19813* (MEXU, MO); Mun. Unión Juárez, Volcán Tacaná, 5 km al E de Talquián, 26 abr. 1987, *Martínez S. & Reyes 20286* (MEXU, MO).

This species is known only from the type locality on Volcán Tacaná, the large volcano straddling the Mexican–Guatemalan border.

This species is most closely related to *Rhipidocladum clarkiae* R. Pohl, *R. panamense* R. Pohl, and *R. sibilans* Davidse, Judz. & L. Clark, narrow endemics of Costa Rica, Panama, and eastern Venezuela and western Guyana, respectively. All four species occur in montane forests. They may be more widespread than present evidence indicates since their infrequent flowering has no doubt discouraged collectors. They may have arisen from a common widespread ancestor that differentiated through isolation in widely separated mountain ranges or, perhaps more likely, they differentiated as new isolated populations from a common ancestor as it spread into previously uninhabited mountain ranges.

Rhipidocladum martinezii resembles *R. clarkiae*, *R. panamense*, and especially *R. sibilans* in its numerous branches per node, small leaf blades, and obviously awned spikelets. The new species differs from *R. clarkiae* in its smaller inflorescences bearing fewer (2–4 vs. 7–8) spikelets per raceme with glabrous versus puberulent rachises, more attenuate, less heavily scabrous lemmas, longer (6–7 vs. ca. 4.5 mm) anthers, and narrower (2.5–3.5 vs. 4–9 mm) branch leaves. *Rhipidocladum martinezii* differs from *R. panamense* in its smaller inflorescences bearing fewer (2–4 vs. 5–7) spikelets per raceme, longer (9.5–12.0 vs. 5.0–6.5 mm) much more attenuate lemma body, and longer anthers. *Rhipidocladum martinezii* differs from *R. sibilans* in its secund (vs. bilateral) raceme with the spikelets more closely spaced (rachis internodes 0.8–1.5 vs. 1.9–3.0 cm long) and glabrous (vs. densely puberulent) rachilla internodes.

This species is named in honor of Esteban Martínez S., Universidad Nacional Autónoma de México, a prolific plant collector and discoverer of many interesting new plants for the flora of Mexico, including all known collections of this new species.

BAMBUSEAE: GUADUINAE

We follow Soderstrom & Londoño (1987) and Soderstrom & Ellis (1987) in recognizing New World *Guadua* Kunth as distinct from the Old World *Bambusa* Schreber, thus necessitating the following new combination.

Guadua longifolia (Fourn.) R. Pohl, comb. nov. Basionym: *Arundinaria longifolia* Fourn., Mexic. Pl. 2: 131. 1886. *Bambusa longifolia* (Fourn.) McClure, Smithsonian Contr. Bot. 9: 66. 1973. TYPE: Mexico. Jicaltepec, April, *Liebmann s.n.* (holotype, C).

Arthrostylidium spinosum Swallen, J. Wash. Acad. Sci. 28: 6. 1938. *Guadua spinosa* (Swallen) McClure, Phytologia 5: 82. 1954, non *Bambusa spinosa* Roxb. ex Buch.-Ham., Trans. Linn. Soc. London 13: 480. 1822. *Bambusa swalleniana* McClure, Smithsonian Contr. Bot. 9: 68. 1973. TYPE: Belize. El Cayo District: along Belize River at El Cayo, June–Aug. 1936, *Lundell 6939* (holotype, US; isotype, MO).

Guadua macclurei R. Pohl & Davidse, sp. nov. TYPE: Honduras. Gracias a Dios: along Río Plátano S of Ras, Moravian Mission settlement called Las Marías or Batituk, elev. 50 m, culms over 10 m long, arching, with numerous elongate spreading branches, this colony vegetative except for one branch 1.5 m long, species is abundant along lower Río Plátano, some colonies blooming, 16 Dec. 1977, *R. W. Pohl & M. Gabel 13340* (holotype, ISC; isotypes, F, MO). Figure 5.

Bambusa lignosa spinosa. Culmi cylindrici cavi, 6–15 m longi, 3–4 cm diametro; nodis supra et infra cristam nodalem annulos trichomatum alborum gerentibus, in medio culmi ramos singulares gerentibus. Folia culmorum vaginis hispidis plerumque exauriculatis interdum auriculato-setosis, deciduis; laminis 7–14 cm longis adaxialiter hispidis trichomatibis plerumque albis. Folia ramorum vaginis auriculis 5.0–8.5 mm longis, lineari-falcatis plerumque munitis; laminis 13–26 cm longis, 1.6–4.8 cm latis, lanceolatis. Inflorescentia rhachidi gracili efoliata usque ad 30 cm longa fasciculos densos numerosos pseudospicularum sessilium gerenti. Pseudospiculae 10–15 mm

Figure 5. *Guadua macclurei* R. Pohl & Davidse. —A. Vegetative branch complement. —B. Culm leaf. —C. Branch leaf detail showing prominent auricles. —D. Flowering branch with clusters of pseudospikelets. —E. Flowering branch originating from a pseudospikelet. —F. Spikelet. (A–C based on *McClure 21476;* D–F based on *Pohl & Gabel 13340.*)

longae, ca. 3 mm latae; flosculo fertili plerumque unico; lemmate 8.5–9.0 mm longo; lodiculis 3, puberulentis; antheris 6, ca. 5 mm longis; stigmatibus 3. Fructus non suppentens.

Caespitose, ligneous, spiny bamboo. Rhizomes short, pachymorph. Culms 6–15 m long, 3–4 cm diam., arching, pendulous above; internodes to 55 cm long, green, sparsely appressed pubescent, hollow, cylindrical, thin-walled; nodes not prominent, with white pubescent bands above and below the nodal ridge. Culm leaves tardily deciduous; sheaths 7–23 cm long, appressed-hispid with white hairs, usually lacking auricles and auricular setae, rarely with linear auricles to 9 mm long bearing prominent setae; internal ligule 1.5–2 mm long, stiff, membranous, minutely ciliolate; blades 7–14 cm long, as broad as the sheath apex, erect, broadly triangular, apiculate, ciliolate, densely appressed-hispid above, sparsely hispid toward the margins below, the hairs usually white or sometimes brown toward the base, the base long-decurrent on one margin. Branch complement consisting of a single primary branch, the lowest nodes bearing 1–several hooked thorns or secondary branches. Branch leaves with the sheaths ciliate, glabrous to hispid on the back; auricles 5–8.5 mm long, linear-falcate, sometimes deciduous or absent; auricular setae 5–9 mm long; external ligule a rim 0.1–0.3 mm long; internal ligule 0.1–0.4 mm long, membranous; pseudopetiole 1.5–2.5 mm long, pilose above; blades 13–26 cm long, 1.6–4.8 cm wide, flat, lanceolate, mostly glabrous, ciliolate. Inflorescence axis to 30 cm, slender, leafless, bearing numerous dense fascicles of sessile pseudospikelets. Pseudospikelets 10–15 mm long, ca. 3 mm wide; basal bracts 2–4, 2–5.5 mm long, similar to the glumes, often subtending axillary pseudospikelets in several orders; each pseudospikelet terminating in a spikelet that disarticulates below its glumes; lower glume 6.0–7.5 mm long, ovate, 11–13-nerved, the apex with a stiff beak ca. 1 mm long; upper glume 8.0–8.7 mm long, similar to the lower glume; bisexual floret usually 1; lemma 8.5–9.0 mm long, 11–15-nerved, broad, apiculate, densely puberulent adaxially in the upper ½; palea broad, outwardly bowed, 8–10-nerved, about as long as the lemma, 2-keeled, the margins each 3-nerved, the keels broadly winged, the wings to 1.5 mm wide, eciliate, completely enfolding the terminal rachilla internode; rachilla stiff, 3–5 mm long, bearing a cylindrical rudiment 3.5–5 mm long; lodicules 3, flat, vasculated, puberulent on the back; stamens 6, the anthers ca. 5 mm long, yellow; stigmas 3. Fruit not available. $2n = 48$.

Paratypes. NICARAGUA. ZELAYA: Bluefields, El Recreo, Agricultural Experiment Station, growing wild, forming isolated colonies of limited extent on upland in quebradas and second-growth jungle, branches all thorny, culms used locally in construction of shade shelters for nursery plants, known locally as "Cuajichote," 23 Jan. 1946, *McClure 21476* (ISC, MO, US), 25 Jan. 1946, *McClure 21479* (MO); road crossing of Río Likus, 1.5 m SE of La Tronquera, S of Waspam, 6 Aug. 1971, *Pohl & Erickson 12700* in part (MO-2613073). HONDURAS. GRACIAS A DIOS: Leymus, orilla del río Segovia o Wankí, 100 km SO de Puerto Lempira, 1 Feb. 1984, *Nelson & Cruz 8696* (MO).

Additional sterile collections tentatively identified as this species and not considered to be paratypes nor used in writing the description are the following: NICARAGUA. ZELAYA: ca. 0.5 km upstream from first suspension bridge over Río Sucio, also known as Río Tunky, E of Rosíta, ca. 13°58′N, 84°28′W, 22 Feb. 1979, *Stevens 12606* (MO); along new road between Rosita and Puerto Cabezas, ca. 15.7 km SW of Río Kukalaya, ca. 13°58′N, 84°12′W, 30 Apr. 1978, *Stevens 8464* (MO); ca. 3.9 km SE of El Empalme on road to Limbaika, ca. 13°39′N, 84°24′W, 25 Apr. 1978, *Stevens 8122* (MO). COSTA RICA. PUNTARENAS: Piedras Blancas, edge of road in lowland forests along Carretera Interamericana, 19 July 1966, *Pohl & Calderón 10103* (MO). PANAMA. BARRO COLORADO ISLAND: 5 Mar. 1983, *Judziewicz 4438* (MO, WIS), 30 Apr. 1970, *Croat 10101* (MO). DARIÉN: along Pan-American Highway between Pucro and Río Punusa, 3 Aug. 1962, *Duke 5401* (MO).

This species is known with certainty only from gallery forests along rivers in the Caribbean coastal plain of Honduras and Nicaragua at an elevation below 100 m. The additional sterile collections cited from Costa Rica and Panama await flowering collections for confirmation. This species is named for F. A. McClure, distinguished student of bamboos, who recognized this species as distinct and gave it a manuscript name, which is unfortunately a later homonym. His detailed notes on vegetative specimens collected at Bluefields, Nicaragua, and portions of his manuscript description have been incorporated into this treatment. The one flowering specimen available to McClure was immature, and some of his statements about the pseudospikelet and spikelet details are not correct.

This species is unusual in the genus in having spikelets with only one or at most a few bisexual florets. Vegetatively it most resembles *G. amplexifolia*, but *G. macclurei* differs in the usually white (not brown) hairs on the upper surface of the culm leaf blades, the frequent occurrence of linear-falcate (not triangular) setose auricles on the branch leaf sheaths, the relatively thinner culm walls, and most notably, in the much narrower pseudospikelets (ca. 3 mm vs. 4–5 mm wide).

OLYREAE

Arberella grayumii Davidse, sp. nov. TYPE: Costa Rica. Puntarenas: along new road from Pie-

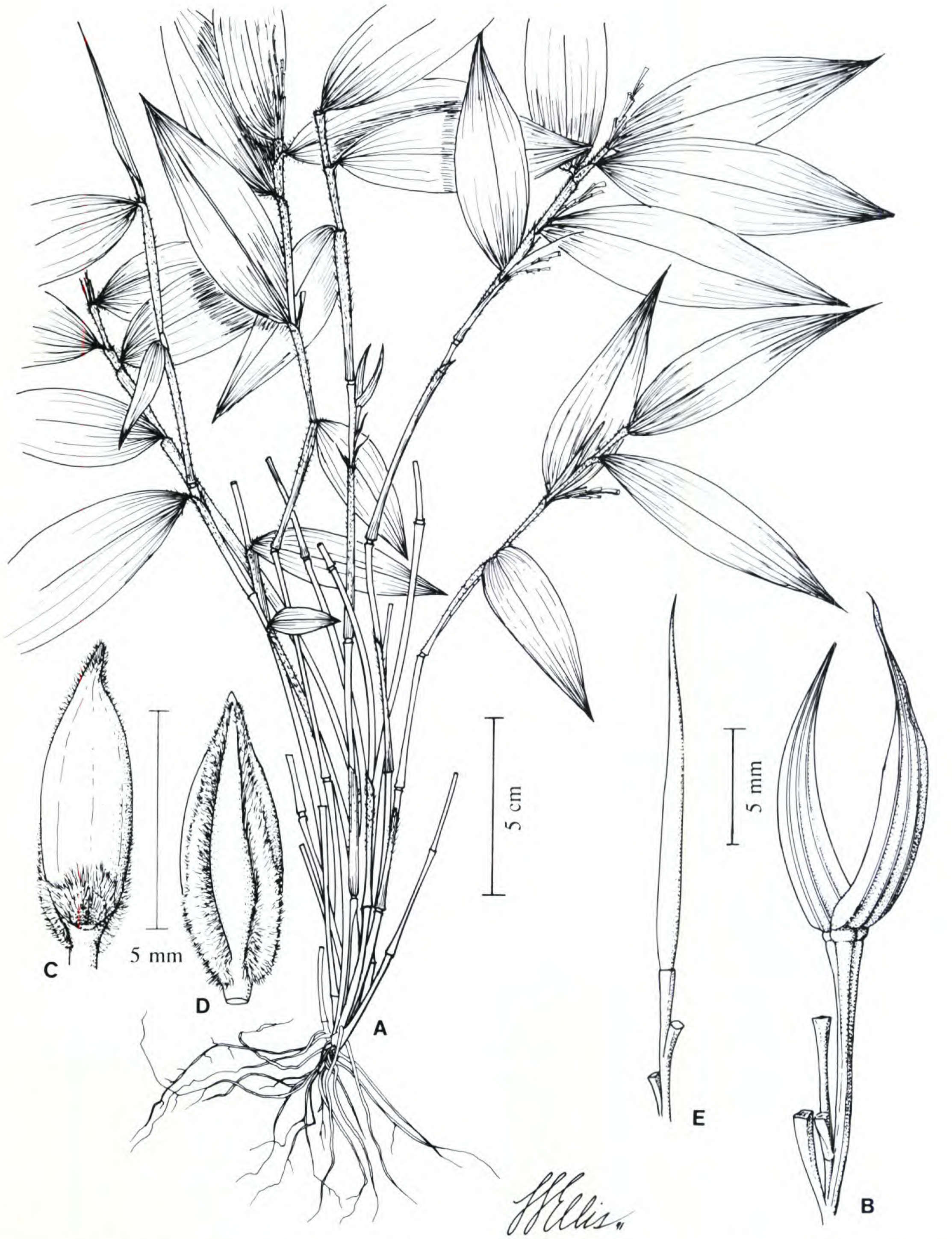

Figure 6. *Arberella grayumii* Davidse. —A. Habit. —B. Inflorescence with terminal female spikelets with only the glumes remaining and the anthoecium dehisced. C, D. Female anthoecium. —C. Dorsal view showing the pubescence around the germination flap. —D. Ventral view showing the prominently ciliate lemma margins. —E. Male inflorescence with terminal male spikelet. (Based on *Grayum et al. 3402.*)

dras Blancas to Rincón de Osa, 8°45′N, 83°21′W, ca. 200 m, scattered on forest floor, 2 July 1984, *M. H. Grayum, B. Jacobs, G. Schatz, J. Kress & P. Sleeper 3402* (holotype, MO; isotypes, CR, US). Figure 6.

Gramen perenne. Folia evoluta in quoque culmo 5–8; vaginis ciliatis et pilosis; pseudopetiolo 1.0–1.5 mm longo; laminis 5–10 cm longis, 1.6–3.0 cm latis, oblongo-ellipticis, apice acuminatis, basi asymmetricis. Paniculae ad quemque nodum medianum et supernum 1–5, 1.5–4.0 cm longae. Spiculae masculae 3.8–5.2 mm longae. Spiculae femineae lanceolatae, 13.5–15 mm longae, ca. 2.5 mm latae; gluma inferna 7-nervi, superna 7-nervi; inter gluma anthoeciumque internodio ca. 1 mm; lemmate ca. 8.7 mm longo, 2.3 mm lato, ciliato dense pubescenti circum operculum germinationis; palea 4-nervi, glabra. Caryopsis non suppetens.

Caespitose, perennial herb. Culms 35–50 cm long, unbranched, erect or geniculate-ascending; internodes terete, shiny, glabrous, hollow, with a gland-like spot on one side toward the apex; exposed nodes 4–5, blackish, glabrous, formed from the thickened basal rim of the sheath above and the thickened upper rim of the internode below. Leaves of the basal nodes consisting of only a sheath shorter than the internode; fully developed leaves 5–8 per culm; sheaths green-mottled, hirsute in the upper half, ciliate; ligule a ciliolate membrane 0.2–0.4 mm long; pseudopetiole 1.0–1.5 mm long, pilose with white hairs on both surfaces; blades 5–10 cm long, 1.6–3.0 cm wide, oblong-elliptic, sparsely to moderately pilose below, glabrous to sparsely pilose above, ciliate, acuminate, basally asymmetrical, the midrib on both surfaces thickened at the base and terminating in a knoblike process. Panicles 1–5 from each of the middle to uppermost nodes, 1.5–4.0 cm long, narrow, erect, with a single large terminal female spikelet and ca. 8–16 paired male spikelets below, one of each pair long-pedicelled, the other short-pedicelled, or the female spikelet lacking and only male spikelets present; axis angular, glabrous; pedicels glabrous, those of the female spikelets prominently thickened at the apex, those of the male spikelets only slightly thickened. Male spikelets 3.8–5.2 mm long, 0.5–0.6 mm wide, linear-lanceolate, acuminate, glabrous, membranous, whitish; lemma 3-nerved, acuminate with an awn tip to 0.5 mm long; palea as long as the lemma body, 2-nerved; lodicules 3, 0.4–0.5 mm long, similar, oblanceolate; stamens 3, the anthers 1.2–1.6 mm long, basifixed. Female spikelets 13.5–15.0 mm long, ca. 2.5 mm wide, lanceolate, long-attenuate, glabrous, whitish; glumes subequal, membranous, longer than the anthoecium, 7-nerved, with a few transverse veinlets; anthoecium ca. 8.7 mm long and 2.3 mm wide, oblong-elliptic, the internode ca. 1.0 mm long; lemma smooth and shiny, whitish when immature, densely and prominently ciliate, also densely pubescent on the germination flap and just above the flap on the back; palea 4-nerved, glabrous; lodicules 3, ca. 1 mm long, vasculated, the posterior one and one of the anterior ones marginally connate, the free anterior one ± dumbbell-shaped; ovary fusiform, ca. 2.8 mm long; style 1, as long as the anthoecium; stigmas not seen. Caryopsis not available.

Arberella Soderstrom & C. Calderón is a small genus of five closely related species, plus the distantly related *A. bahiensis* Soderstrom, the only species that lacks the elongated internode between the glumes and anthoecium (cf. Soderstrom & Zuloaga, 1985). *Arberella grayumii* differs from all the glabrous-leaved species (*A. bahiensis*, *A. flaccida* (Doell) Soderstrom & Zuloaga, *A. dressleri* Soderstrom & C. Calderón) in its much broader blades, glabrous female palea, and different pubescence pattern on the back of the female lemma.

In Mesoamerica the four known species of *Arberella* occur only in tropical wet forests and have very limited distributions: *A. grayumii* is only known from the Osa Peninsula on the Pacific side of Costa Rica; *A. costaricensis* (A. Hitchc.) Soderstrom & C. Calderón is only known in the Río Hondo area on the Atlantic side of Costa Rica; *A. dressleri* is known from eastern Colón and western San Blas, Panama, on both sides of the continental divide but is most common on the Caribbean side; and *A. lancifolia* Soderstrom & Zuloaga is the most widespread Mesoamerican species, ranging from San Blas to Bocas del Toro, Panama. *Arberella lancifolia* occurs only along the Caribbean slope in the western part of its range but crosses the lower continental divide in the eastern part of its range.

This species is named for Michael H. Grayum, Missouri Botanical Garden, in recognition of his outstanding work on the flora of Costa Rica. It is only known from the type collection.

Cryptochloa soderstromii Davidse, sp. nov. TYPE: Panama. San Blas: Ailigandi, area along trail from ocean to waterfall on river, 0–200 ft., culms clumped, to 1 m tall, leaves dark green matte above, burgundy below, on slope along river, 7 Oct. 1978, *B. Hammel & W. G. D'Arcy 4984* (holotype, MO; isotype, US). Figure 7.

Gramen perenne. Culmi 60–100 cm longi. Folia in complemento 7–9, scaberula; vaginis auriculatis marginibus glabris; ligula 2–8 mm longa, asymmetrica; laminis 10–13 cm longis, 3–4 cm latis, oblongo-elliptico-ovatis.

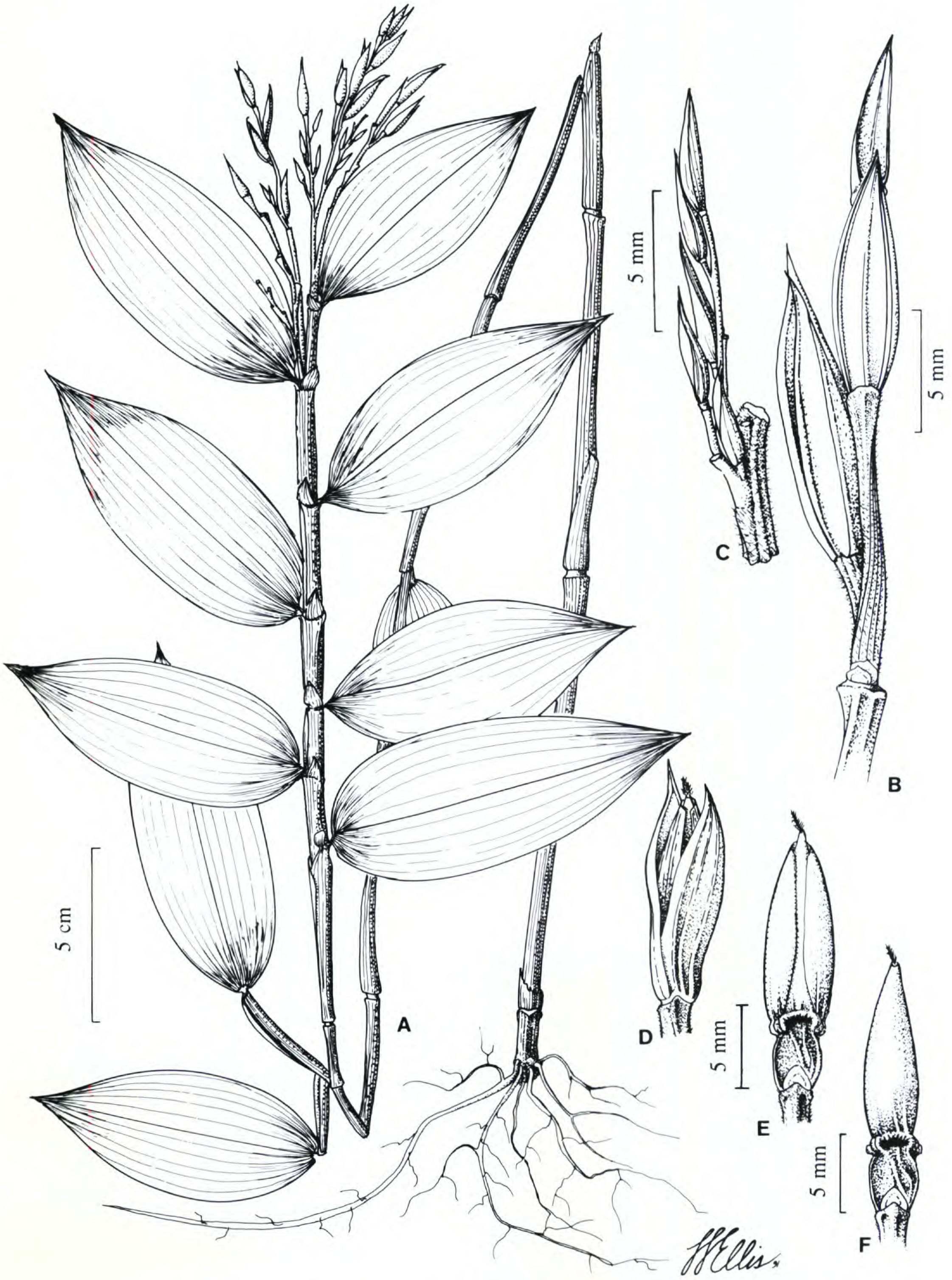

Figure 7. *Cryptochloa soderstromii* Davidse. —A. Habit. —B. Portion of inflorescence with female spikelets. —C. Portion of inflorescence with male spikelets. —D. Female spikelets. E, F. Female anthoecium (immature) with prominent basal internode. —E. Ventral view. —F. Dorsal view. (Based on *Hammel & D'Arcy 4984.*)

Inflorescentiae paniculatae, ad quenque nodum foliarem 2–3, terminales et axillares, spiculas femineas apicem versus et masculas basim versus gerentes. Spiculae masculae 3.5–5.0 mm longae muticae; antheris 3, 3.3–3.6 mm longis. Spiculae femineae 9–13 mm longae; glumis 7–9-nervibus acutis vel aristatis ad 1–3 mm; flosculo 7.8–8.3 mm longo, 1.9–2.0 mm lato. Caryopsis non suppetens.

Caespitose, perennial herb. Culms 60–100 cm long, erect, with up to 6 elongated internodes bearing sheaths without or with reduced blades preceding the section of the culm bearing the leaf complement; internodes hollow, glabrous or sparsely scaberulous between the veins at the apex, longer than the associated sheath in the lower half, shorter in the leaf complement; nodes glabrous to appressed scaberulous. Leaves with developed blades 7–9 per complement, scaberulous; sheaths prominently auricled, the auricle adnate to the ligule, the margins glabrous; ligule asymmetrical, 5–8 mm on the underlapping side of the sheath, 2–3 mm on the overlapping side, membranous, glabrous on the back, ciliolate; pseudopetiole ca. 1.5 mm long, scabrous; blades 10–13 cm long, 3–4 cm wide, oblong- to elliptic-ovate, glabrous, basally rounded, slightly asymmetric, apically abruptly acuminate. Panicles terminal and axillary, 2–3 from each of the uppermost leafy nodes, bearing female spikelets toward the tip and male spikelets toward the base; peduncles not exserted from the sheath; branches appressed, scaberulous, ridged; female pedicels thickened at the tip, solitary; male pedicels slender at the tip, solitary or in short- and long-pedicelled pairs. Male spikelets 3.5–5.0 mm long, awnless, disarticulating immediately after anthesis as one unit, glabrous; lemma and palea subequal; lemma 3-nerved; palea 2-nerved; lodicules 3, truncate; stamens 3, the anthers 3.3–3.6 mm long. Female spikelets 9–13 mm long including the awn tips, fusiform, disarticulating above the glumes; glumes as long as the spikelet, 7–9-nerved, glabrous without, scabrous in the upper ⅓, with 3 strong nerves and 4 or 6 weak ones near the margin, with transverse veinlets, the lower acute or with an awn tip to 3 mm long, the upper acute or with an awn tip to 1 mm long; internode between the glumes and anthoecium 1.6–2.2 mm long; anthoecium 7.8–8.3 mm long, 1.9–2.0 mm wide, shiny; lemma 5-nerved; palea 2-nerved, nearly as long as the lemma; lodicules 3, truncate, vasculated, eciliate; style 1, as long as the anthoecium; stigmas 2; caryopsis not available.

Cryptochloa soderstromii is very closely related to the South American *C. capillata* (Trin.) Soderstrom but differs in its smaller (3.5–5.0 mm vs. 6.0–9.0 mm), essentially awnless, male spikelets, eciliate sheath margins, smaller female spikelets (9–13 mm vs. 20–23 mm) with essentially awnless glumes or with the lower glume sometimes with an awn point to 3 mm long, and inflorescence branches more appressed, somewhat thicker, and not as highly branched.

It is similar to *C. capillata* in its large size, similar leaves with similar ligules, and paniculate terminal inflorescences. In *C. soderstromii* the terminal inflorescence bears both male and female spikelets.

In *C. capillata*, as Soderstrom (1982) noted when he transferred this species to *Cryptochloa* Swallen from *Olyra* L., the terminal panicle may bear a mixture of male and female spikelets, or it may be uniformly unisexual, in which case it usually bears male spikelets, or only rarely female spikelets. In other species of *Cryptochloa* the terminal inflorescences are nearly always male, and they are usually much smaller. Whether *C. soderstromii* also usually produces terminal male inflorescences awaits further observations on new collections.

The species is named for the late Thomas R. Soderstrom, who through his careful work and great enthusiasm for the herbaceous bamboos, greatly increased our understanding of this group. It is known only from the type collection.

PARIANEAE

The genus *Pariana* Aublet consists of approximately 38 species distributed in lowland and lower montane rainforests from Costa Rica (and probably southern Nicaragua) south to Brazil and Bolivia. It is especially abundant in the Amazon Basin. Victoria C. Hollowell is currently monographing the genus.

It is not surprising that a new species needs to be described since Costa Rica–Panama is one of the major centers of bamboo diversity in the Neotropics, with many species still awaiting description (Soderstrom et al., 1988).

Pariana argentea Hollowell & Davidse, sp. nov. TYPE: Panama. Panamá: El Llano–Cartí Road, 4 mi. beyond the (Pan-American) Highway, 500 m, in shade of forest, spikes green, the stamens yellow, 5 Dec. 1979, *T. B. Croat 49139* (holotype, MO).

Gramen perenne rhizomatibus brevibus. Culmi dimorphi; culmi steriles ad 40 cm longi, erecti vel geniculati, ascendentes; culmi fertiles ad 20 cm longi, decumbentes. Folia vaginis truncatis, fimbriatis, hirtellis; laminis linearibus vel lineari-lanceolatis, adaxialiter viridibus, abaxialiter manifeste argenteo-glaucis. Inflorescentiae spiciformes, ad 4.3 cm, terminales, graciles, gynecandrae, ex verticillis spicularum dimorpharum constantes. Spiculae masculae flosculum unum gerentes, lemmate anguste elliptico, stam-

inibus 9–15(–18). Spiculae femineae flosculum unum gerentes, glumis glabris, costatis, anthecio longioribus.

Caespitose, perennial herb. Culms dimorphic. Sterile culms to 40 cm long, erect from decumbent bases; internodes hollow, terete, the basal ones short, the intermediate ones elongated, the apical ones shortened and hidden within the leaf complement; nodes vinaceous or stramineous, glabrous, linear to dilated and biannular, the lower usually geniculate. Fertile culms to 20 cm, basally decumbent, reduced and often flexuous, bearing bladeless sheaths, the sheaths basally imbricate, inflated and loose, stramineous or vinaceous-tinted. Leaves at lower and midculm nodes of sterile culms reduced to bladeless sheaths, often vinaceous-tinted, imbricate at culm bases but equaling to half as long as the internodes above. Upper leaves of sterile culms 7–10, forming a terminal complement with fully developed blades; sheaths truncate, dorsally keeled, hirtellous or glabrate, with 1–3 lunar marks at the summit; oral setae to 8 mm long, numerous, spreading, antrorsely scaberulous; ligules 0.6–0.7 mm long, truncate, scarious, usually obscured by oral setae and lateral callosities; pseudopetioles 1.5–2.5 mm long, glabrate, stramineous or vinaceous-tinted; blades 6.1–12.0 cm long, 0.8–1.1(–1.6) cm wide, linear or linear-lanceolate, basally cuneate, apically acuminate or setaceous, glabrous, conspicuously blue-white or silver glaucous below. Inflorescence to 4.4 cm long, ca. 1.0 cm wide, slender; spikelets in ca. 7 whorls, these overlapping up to ½ the length of the staminate pedicels of the whorl above; elaiosomes developed on the rachis segment at the base of the pedicels. Staminate spikelets 7.2–8.3(–10.3) mm long; pedicels 3.2–4.0 mm long, shorter than or occasionally subequal to the lemma, basally canescent, marginally ciliate; glumes 2.0–2.8 mm long, stiffly triangular, apically setaceous, 2–3-nerved, to ⅔ as long as the lemma, scaberulous or basally ciliate; lemmas 3.5–4.0(–6.0) mm long, narrowly elliptic, acuminate, glabrous; paleas subequal to the lemmas, often 4(–5)-nerved; lodicules 2, to 0.5 mm long, frontally directed at the palea margins, obovate; stamens 9–15(–18), the anthers 2.6–2.8 mm long, yellow, fully exserted at anthesis. Pistillate spikelets 5.3–6.1 mm long, sessile; glumes 5.3–6.1 mm long, subequal, overtopping the anthoecium by 0.6–1.1 mm, costate with faint marginal nerves occasionally evident, glabrous except scaberulous along the costa and apical margins; anthoecium 4.8–5.2 mm long, ovate, glabrous; lodicules 3, the anterior pair to 1.5 mm long, obovate, acute with apical microhairs, membranous, the posterior one to 0.5 mm long, elliptic, lacking apical microhairs; style 1, short, glabrous; stigmas plumose, subapically exserted.

Paratypes. PANAMA. PANAMÁ: Cartí Road, 7 mi. from turnoff at El Llano, in forest along road, 9°15′N, 78°58′W, 320 m, occasional on slopes in forest, leaves glaucous below, 16–17 Apr. 1985, *Hammel 13546* (MO); El Llano–Cartí Road, 10 km from Inter-American Highway, forest grass, anthers yellow, 4 Oct. 1974, *Mori & Kallunki 2292* (MO); El Llano–Cartí Road, 6–7 mi. from Pan-American Highway, wet tropical forest, 300–350 ft., herb, leaves silvery below, inflorescence light green, stamens yellow, on a separate leafless scape, 28 Apr. 1981, *Sytsma 4151* (MO).

Pariana argentea is, as far as presently known, endemic to a small area on the Pacific slope of east-central Panama in the Province of Panamá, where it occurs in moist tropical forest.

Pariana argentea is distinguished by its narrow leaf blades with silvery, glaucous abaxial surfaces (the character from which the name is derived) and its decumbent, flexuous fertile culms. It is most closely related to *P. strigosa* Swallen and *P. gracilis* Doell. From the first it differs most notably in its smaller (6.1–12.0 × 0.8–1.1(–1.6) cm vs. 12.0–15.0 × 4.5–5.5 cm), linear to linear-lanceolate (not ovate to ovate-lanceolate) leaf blades, more numerous (not few or absent) and longer (to 8 mm vs. ca. 4 mm) oral setae, and pistillate glumes glabrous except for the scaberulous costae and apical margins (not puberulent and ciliate). It differs from *P. gracilis* in its glaucous (not green) lower leaf surfaces and more numerous stamens.

One collection (*Hammel 13546*) with the distinctive foliage of *P. argentea* has atypically large spikelets that resemble those of *P. simulans* Tutin and *P. strigosa*. These two larger species have puberulent pistillate glumes in contrast to the glabrous ones of *P. argentea*. This anomalous collection may also have lightly puberulent pistillate glumes, another intermediate spikelet feature, which suggests the possibility of hybridization and introgression among these three sympatric species. Of interest was the incidence of immature insects and insect damage within the florets of this anomalous collection.

Also notable is the differentiation of the rachis internode at the base of each spikelet whorl into a distinct callus. This callus is noticeably swollen in spikelet whorls containing mature pistillate spikelets, i.e., those bearing fully developed caryopses. Microscopic examination and staining with Sudan IV (a lipid-specific stain) of this callus in mature spikelet whorls of *Hammel 13546* showed that the swelling was caused by the accumulation of oil. Davidse (1987) has reviewed the occurrence of similar struc-

tures in other genera of grasses and has interpreted them as elaiosomes, which may be effective in ant dispersal. This interpretation also seems to apply to *P. argentea* and is probably also true of many other species in the genus.

BROMEAE

Bromus exaltatus Bernh., Linnaea 15(Litt. Ber.): 90. 1841. TYPE: Mexico. *Anonymous s.n.* (lectotype, selected here, MO-2957788).

In the only major revision of *Bromus* in Mexico and Central America, Soderstrom & Beaman (1968) neotypified *B. exaltatus* Bernh., the earliest name of section *Bromopsis* Dumort. (sect. *Pnigma* Dumort.) that applies to a Mesoamerican species. They assumed that the type specimen from the Bernhardi Herbarium (MO) was still missing, as both Wagnon (1950), on the authority of George B. Van Schaack, and Shear (1901), on the authority of W. Trelease, had reported. Although we do not know what may have happened to these specimens in the first part of this century (perhaps misfiled or not recognized as types), they were later found and annotated by Van Schaack. Two sheets, both representing the same species, exist. As is unfortunately characteristic of many specimens in the Bernhardi Herbarium, both are poorly labeled with minimal information. According to the annotation by Van Schaack, who interpreted the handwriting, one of the specimens, MO-2957788, has a label with "*Bromus exaltatus*, Mexico," in pencil in Bernhardi's own handwriting. The second specimen only bears an unpublished name. Since these are original specimens used by Bernhardi to write his description, the earlier neotypification is superseded and the first specimen is here chosen as the lectotype.

The lectotype has 3-nerved, pubescent glumes, pubescent lemmas 9.5–11.5 mm long, rounded on the back, auriclate sheaths, glabrous, obtuse ligules 0.8–1.1 mm long, a large nodding panicle, blades 7–9 mm wide, and anthers 2.7 mm long.

Both Wagnon (1950) and Soderstrom & Beaman (1968) commented on Bernhardi's description of the lower glume as 4-nerved. This was a simple mistake as all lower glumes in the lectotype are 3-nerved, with the lateral nerves weak in a few spikelets.

Since Soderstrom & Beaman (1968) greatly emphasized glume nervation as a key character, most specimens that we recognize as *B. exaltatus* would key out as *B. porteri* (J. Coulter) Nash in their treatment. However, *B. porteri* is a nonauriculate species of northern Mexico and the western United States, and we have not seen any specimens from Mesoamerica.

TRITICEAE

Agropyron attenuatum (Kunth) Roemer & Schultes is the most widespread native species of Triticeae in Latin America. It ranges along the main cordilleras from Costa Rica to Argentina.

We, like Löve (1984), place this species in the genus *Elymus* L. However, while transferring this species to *Elymus*, Löve (1984) inexplicably created an illegitimate later homonym while citing the legitimate earlier combination with this epithet. Thus, a new name is required for this species in *Elymus*.

Elymus cordilleranus Davidse & R. Pohl, nom. nov. Replaced name: *Elymus attenuatus* A. Löve, Feddes Repert. 95: 473. 1984, non (Griseb.) K. Richter, 1890, based on *Triticum attenuatum* Kunth in Humb., Bonpl. & Kunth, Nov. Gen. Sp. 1: 180. 1816. *Agropyron attenuatum* (Kunth) Roemer & Schultes, Syst. Veg. 2: 751. 1817. TYPE: Ecuador. Propter Burropotrero et Chillo Quintensium, *Humboldt & Bonpland s.n.* (P).

ARUNDINEAE

Danthonia chiapasensis Davidse, sp. nov. TYPE: Mexico. Chiapas: steep slopes with montane rainforest, evergreen cloud forest and elfin forest, *Drimys*, *Quercus*, *Ostrya*, *Liquidambar*, *Styrax*, and *Ilex*, on the SE side of Cerro Tres Picos and the ridges near summit, elev. 2,100–2,500 m, 11 Dec. 1972, *D. E. Breedlove & R. F. Thorne 30108* (holotype, DS).

Gramen perenne caespitosa. Culmi 40–60 cm longi. Folia laminis 20–45 cm longis, plerumque involutis sed ad 5 mm latis ubi complanatis. Panicula 8–13 cm longa, ca. 1.5 cm lata, ramis glabris. Spiculae 17–21 mm longae; flosculis 5–6; lemmate infimo usque ad aristae centralis insertionem 4.0–4.5 mm longo, 9-nervi, dorsaliter pilosa in dimidio inferiore, dentibus lateralibus 8.0–9.5 mm longis aristam includentibus, aristis centralibus ad 25 mm longis, callo piloso trichomatibus 0.5–1.0 mm longis. Caryopsis non suppetens.

Densely caespitose, perennial herb; innovations intravaginal. Culms 40–60 cm long, erect, glabrous. Leaves basal and cauline; sheaths rounded on the back, glabrous except for tufts of hairs 0.7–1.1 mm long in the auricular area; ligule a dense row of hairs 0.5–1.5 mm long; blades 20–45 cm long, mostly involute, to 5 mm wide when flat, glabrous to sparsely pilose toward the base above and below, the upper surface deeply and closely furrowed. Panicle 8–13 cm long, ca. 1.5 cm wide, linear; branches to 7 cm long, ascending, glabrous. Spikelets 17–21 mm long; glumes subequal, as long as the spikelet,

lanceolate, long-acuminate, 3–5-nerved, purplish in the center, translucent whitish toward the margins; florets 5–6, smaller upwards, the uppermost rudimentary; lowermost lemma 4.0–4.5 mm to the point of insertion of the central awn, 9-nerved, pilose on the back and along the margins in the lower half, the lateral teeth prominent, awned, 8.0–9.5 mm long including the awn, the central awn to 25 mm long, the basal part flattened and twisted; lowermost palea ca. 6 mm long, prominently 2-keeled, acute, sulcate between the scaberulous keels; callus linear, pilose with hairs 0.5–1.0 mm; lodicules 2, obovate, obtuse, vasculated, sparsely ciliate with hairs to 0.5 mm long; stamens 3, the anthers 1.7–3.4 mm; styles 2, separate, the stigmas plumose; caryopsis not available.

This species is only known from the type locality in the Sierra Madre in the State of Chiapas (after which it is named), at ca. 16°12′N, 93°37′W.

Only one other native species of *Danthonia* DC. is known from Mesoamerica, *D. filifolia* Hubb., which ranges from Puebla, Mexico, to Guatemala. *Danthonia chiapasensis* is easily distinguished from that species by the lemma, which is prominently long-pilose on the back (vs. glabrous), and the short-pilose callus (0.5–1.0-mm vs. 3–5-mm-long hairs).

Although it may not necessarily be particularly closely related to either, it is morphologically most similar to *D. parryi* Scribner from the Rocky Mountains in the north, and *D. cirrata* Hackel & Arechav. from southern Brazil, Uruguay, and Argentina in the south.

Danthonia parryi differs from *D. chiapasensis* in its larger spikelets, smaller inflorescences, puberulent panicle branches, broader and less prominently nerved glumes and lemmas, and broader calluses. *Danthonia cirrata* differs in its narrower leaf blades, florets smaller in all parts, and denser lemma pubescence.

Conert (1987) has pointed out that *Danthonia* (sens. lat.) in the New World has a large gap in its distributional range in that seven species occur primarily in the United States and 18 species in southern South America. In the north only *D. spicata* (L.) P. Beauv., primarily of the United States, ranges as far south as Puebla, Mexico, but it becomes quite rare in the southernmost part of its range. In the south the widely ranging *D. secundiflora* J. S. Presl reaches as far north as Colombia. *Danthonia chiapasensis* and *D. filifolia* partially bridge the gap along the probable Cordilleran migration route for the genus. Interestingly, they each represent one of the major morphological groups of *Danthonia* (sens. str.) in the Americas, i.e., those with lemmas long-pilose all over the back, and those ciliate only along the margins.

ERAGROSTIDEAE: ELEUSININAE

Eragrostis rufescens Schrader ex Schultes var. **mesoamericana** Davidse, var. nov. TYPE: Honduras. Morazán: 2.5 km N of Zambrano on road to San Francisco de Soroguara, pine forest along a small stream, on dry tuff outcrops, elev. 1,370 m, 1 July 1970, *R. W. Pohl & G. Davidse 12125* (holotype, MO; isotype, ISC).

A var. *rufescenti* inflorescentiis ramorum axillis pilosis et pedicellis divergentibus differt.

Caespitose, eglandular, annual herb. Culms 5–35 cm tall, erect to decumbent, usually unbranched, glabrous. Leaves mostly basal; sheaths rounded, glabrous to papillose-pilose, the apex pilose; ligule 0.1–0.2 mm long, a row of hairs; blades 5–20 cm long, 2.0–4.5 mm wide, flat to rolled, papillose-pilose to glabrous. Panicle 2–13 cm long, 1.5–6 cm wide, ellipsoid to ovoid, moderately dense; axils densely pilose, rarely sparsely pilose or nearly glabrous; branches spikelet-bearing to the base; pedicels much shorter than the spikelets, slightly divergent. Spikelets 8–15 mm long, 1.6–2.3 mm wide, oblong to oblong-lanceolate, purplish, disarticulating from the base; glumes 1-nerved, acute, the lower 1–2 mm long, the upper 1.2–1.8 mm long; rachilla persistent; florets 13–45; lemmas 1.4–2.1 mm long, acute, sharply keeled, scaberulous on the keels, overlapping for ½–¾ of their length, the lateral nerves evident; paleas ¾ to nearly as long as the lemmas, the keels ciliolate; stamens 2, the anthers 0.2–0.3 mm, purple. Caryopsis 0.4–0.5 mm long, 0.3 mm wide, ovate in outline, roundly triangular in cross section, apically obtuse.

Paratypes. MEXICO. VERACRUZ: Coatzacoalcos, 21 Mar. 1910, *Orcutt 3103* (MO). TABASCO: Mun. Huimanguillo, Laguna de los Limones, 18 Nov. 1981, *Magaña & Zamudio 111* (MO). CHIAPAS: Mun. La Trinitaria, 9 km S of Comitán, 6 Nov. 1981, *Breedlove & Davidse 54951* (CAS, MO); Mun. La Trinitaria, 10 km E of La Trinitaria, 7 Nov. 1981, *Breedlove & Davidse 54977* (CAS, MO). BELIZE. BELIZE: mi. 7 on Northern Highway, 23 Jan. 1974, *Dwyer & Liesner 12147* (MO); from Belize City to 5 mi. beyond Ladyville Estates, 22 Mar. 1973, *Dwyer 10403* (MEXU, MO); Sibun River, 25 Feb. 1936, *Gentle 1812* (MO); Belize, 29 Jan. 1931, *Bartlett 11257* (MO). CAYO: road S to Augustine and San Luis to Camp Six, 19 Mar. 1967, *Dwyer et al. 300* (MO). ORANGE WALK: 5 km N of August Pine Ridge, 19 Mar. 1987, *Davidse & Brant 32778* (MO). TOLEDO: lower part of Richardson Creek, 2–3, 11 Mar. 1987, *Davidse & Brant 32326* (MO). GUATEMALA. CHIQUIMULA: 10 km ESE of Esquipulas, 12 Aug. 1970, *Harmon & Dwyer 3746* (MO).

HONDURAS. COLÓN: 4.5 mi. NE of Trujillo, 28 Jan. 1981, *Saunders 959* (MO). COMAYAGUA: Siguatepeque, 26 May 1972, *Burch 6144* (MO). EL PARAÍSO: road to Yuscarán, 21 Dec. 1975, *Williams et al. 31196* (MO); 2 mi. W of Güinope, 5 Jan. 1947, *Williams & Molina R. 11518* (MO); 3 km NW of Güinope, 27 Feb. 1949, *Williams & Merrill 15704* (MO); 25 km W of Danlí, 20 July 1971, *Pohl 12612* (MO). GRACIAS A DIOS: Ahuas, 12–14 dic. 1972, *Clewell 3606* (MEXU, MO). LEMPIRA: cerca la ciudad de Gracias, 7–9 dic. 1971, *Nelson et al. 176* (MO). FRANCISCO MORAZÁN: 8 km E of El Zamorano, 14 June 1970, *Pohl & Davidse 11911* (MO); El Zamorano, 2 Nov. 1981, *Swallen 11266* (MO); 14 km NW of Lepaterique, 2 Jan. 1979, *Pohl & Gabel 13865* (MO); 4 km SE of Río Agua Caliente, 1 Jan. 1979, *Pohl & Gabel 13848* (MO). OCOTEPEQUE: 8 km SW of Santa Fé, 16 Jan. 1976, *Williams et al. 31263* (MO). OLANCHO: 11 km NE of Pataste, 23 Dec. 1978, *Pohl & Gabel 13779* (MO). NICARAGUA. COMARCO DEL CABO: near Bilwaskarma, 12 Mar. 1971, *Seymour 4579* (MO). ZELAYA: junction of road to Alamikanba with road between El Empalme and Limbaika, 24 Feb. 1979, *Stevens 12780* (MO). COSTA RICA. GUANACASTE: 5 km S of Liberia, 5 Dec. 1968, *Pohl & Davidse 11553* (MO). SAN JOSÉ: vic. of El General, Dec. 1936, *Skutch 3068* (MO).

This variety has been collected in *Trachypogon* savannas, open areas in *Pinus* forests, and in *Pinus* savannas at 0–1,600 m elevation from Oaxaca, Mexico, to Costa Rica.

This distinctive suite of specimens from Oaxaca and Veracruz to Costa Rica has an acute lemma apex. They have almost invariably been identified as *E. maypurensis* (Kunth) Steudel, a widespread species ranging from Durango, Mexico, to Brazil and Bolivia. However, true *E. maypurensis* has an acuminate, somewhat divergent lemma apex. These Mesoamerican specimens agree well in general morphology and spikelet characters with *E. rufescens*, a South American species, previously unreported from Mesoamerica. The Mesoamerican plants differ somewhat from the South American plants in having the main axils of the inflorescence branches usually densely pilose (rarely sparsely pilose or nearly glabrous) versus glabrous or sparsely pilose and in having the spikelets more divergent from the inflorescence branches versus virtually appressed in typical *E. rufescens*. For these reasons the Mesoamerican plants are recognized as a new variety. The epithet reflects its Mesoamerican distribution.

CYNODONTEAE: BOUTELOUINAE

Chondrosum Desv. has most recently been recognized by Clayton (1982) and Clayton & Renvoize (1986). The species included have usually been placed in *Bouteloua* Lagasca (e.g., Griffiths, 1912; Gould, 1980a), from which they differ in having usually fewer pectinate spikes whose spikelets disarticulate above the glumes. Species retained in *Bouteloua* usually have numerous spikes that disarticulate as a unit from the rachis. The recognition of both genera for *Flora Mesoamericana* requires one new combination.

Chondrosum hirsutum (Lagasca) Sweet, Hort. Brit. 455. 1827. *Bouteloua hirsuta* Lagasca, Varied. Ci. 2: 141. 1805. TYPE: Cult. Madrid Bot. Gard., *Lagasca s.n.* (lectotype, selected by Gould (1979), MA).

Chondrosium hirtum Kunth in Humb., Bonpl. & Kunth, Nov. Gen. Sp. 1: 176. 1816. TYPE: Crescit in temperatis, apricis Novae Hispaniae, inter Mexico et Gasave, alt. 1180 hex., *Humboldt & Bonpland s.n.* (P).

The treatment in Sweet consists only of the statement, "4. *hirsutum* Hairy." This appears to be a very deficient description, but Sweet referred in his naming of the genus to "K.S." This cryptic reference appears to be Kurt Sprengel's sixteenth edition of *Systema Vegetabilium*. Page 293 of this work contains a portion of Sprengel's treatment of *Atheropogon* Muhlenb., a synonym of *Bouteloua*. Number 3 of Sprengel's listing is *A. hirtus*, indicated by him as a reference to *Chondrosium hirtum* Kunth (1816) or the earlier *Bouteloua hirsuta* Lagasca (1805).

Chondrosum hirsutum (Lagasca) Sweet var. **glandulosum** (Cerv.) R. Pohl, comb. nov. Basionym: *Erucaria glandulosa* Cerv., Naturaleza (Mexico City) 1: 347. 1870. TYPE: Mexico. In collibus de Guadelupe, et de Moctezuma prope Mexicum.

ERAGROSTIDEAE: SPOROBOLINAE

Pereilema diandrum R. Pohl, sp. nov. TYPE: Costa Rica. Heredia: Puente Mulas, S of San Antonio, canyon of Río Virilla, 850 m, 28 Nov. 1968, *R. W. Pohl & G. Davidse 11482* (holotype, ISC, fragment, MO; isotype, US).

Gramen annuum caespitosum a *P. beyrichiano* (Kunth) A. Hitchc. panicula densiore ramis ascendentibus superpositis, arista lemmatis 10–24 mm longa, antheris duabus et chromosomatum numero $2n = 80$ recedit.

Caespitose, annual herb. Culms 40–80 cm long, sometimes decumbent and rooting from lower nodes, usually simple; internodes 1–2 mm diam., slightly scabrid, often reddish; nodes glabrous. Leaves with the sheaths shorter than the internodes, scabrid; prophylls prominent, 2–3 cm long, bifid; ligule a thick membrane 0.7–1 mm long; blades 10–20 cm long, 5–8 mm wide, scabrid; auricles prominent, clasping, ciliate. Panicle solitary, terminal on the

main culm or leafy branches, 10–20 cm long, 1–2 cm wide, cylindrical; peduncle included or exserted to 6 cm; rachis angular, ciliate-scabrous; branches ascending, overlapping, solitary, 1–3 cm long, densely covered with dense fascicles of spikelets. Sterile spikelets reduced to bristles 3–5 mm long; functional spikelets terete; glumes subequal, 0.7–1.5 mm long, oblong to broadly ovate, 1-nerved, with an awn 1.5–4 mm long; lemma 1.9–2.5 mm long, 3-nerved, scabrid, with a straight awn 10–24 mm long; callus hairs 0.6–0.8 mm, scant; palea bidentate, slightly longer than the lemma; stamens 2, the anthers 0.8–1.0 mm long, often purple. $2n = 80$ from type.

Representative paratypes. COSTA RICA. SAN JOSÉ: Río Tiliri, *Tonduz 3121* (ISC); San Francisco de Guadalupe, *Tonduz 9817* (ISC, US); Llano Grande de Puriscal, *Jiménez 890* (US). ALAJUELA: Carrillos de Poás, *Brenes 14606* (US). Numerous other specimens from the San José area are in US.

This species is only known from the Meseta Central and Cantón de Dota, Costa Rica, at elevations of 500–1,200 m.

This species is similar to *P. beyrichianum* (Kunth) A. Hitchc. (syn. *P. brasilianum* Trin.) of South America, differing in the denser panicle with ascending appressed branches, longer lemma awn, possession of 2 anthers (basis of the epithet) rather than 3, and in the octoploid chromosome number, $n = 40$. The chromosome number of *P. diandrum* was determined from the type but was mistakenly reported under the name *P. beyrichianum* (Pohl & Davidse, 1971). The only known count for true *P. beyrichianum* is $n = 20$ (Davidse & Pohl, 1978, as *P. brasilianum* Trin.). It differs from Mesoamerican *P. crinitum* J. S. Presl in its straight rather than flexuous awn, broader leaf blades, and in chromosome number. The chromosome number for *P. crinitum* has been reported as $n = 10$ (Gould & Soderstrom, 1970; Pohl & Davidse, 1971; Davidse & Pohl, 1974; Reeder, 1984).

PANICEAE: SETARIINAE

Panicum aquaticum Poiret var. **cartagoense** Davidse, var. nov. TYPE: Costa Rica. Cartago: 0.5 km E of Planta Radiográfica along railroad, 2 km W of Paraíso, 1,300 m, open grass marsh, plants 1–2 m tall, rooted in dense tangle of herbage, chromosome number determined to be $n = 36$, 6 Feb. 1969, *R. W. Pohl & G. Davidse 11700* (holotype, ISC).

A var. *aquatico* culmis longioribus simplicibus foliorum vaginis pubescentibus paniculis grandioribus et foliorum laminis erectis differt.

Perennial, rhizomatous herb. Culms 1–2 m long, erect, unbranched; internodes and nodes glabrous. Leaves with sheaths papillose-pubescent to glabrescent; ligule with the membrane 0.4–0.6 mm long and the cilia 0.7–1.0 mm long; blades to 35 cm long, 7–10 mm wide, sparingly pilose. Panicle ca. 27 cm long, terminal; branches 10–14 cm long, scaberulous. Spikelets 3.0–3.1 mm long, basally in unequal pedicellate pairs, terminally solitary, lanceoloid-ellipsoid, glabrous; lower glume 0.8–1.0 mm long, $\frac{1}{5}$–$\frac{3}{10}$ as long as the spikelet, 1-nerved, obtuse; upper glume as long as the lower lemma, 7-nerved, acute; lower floret staminate; lower lemma as long as the spikelet, 7–9-nerved, acute; lower palea as long as the lower lemma; stamens 3, the anthers 0.7–1.4 mm long; upper floret 1.9–2.0 mm long, 0.9–1.0 mm wide, smooth and shiny, glabrous, acute; stamens 3, the anthers 1.3–1.4 mm long.

This distinctive middle-elevation population is only known from the type collection. It is perennial, has spikelets like *P. aquaticum*, but differs from the typical variety of the species by its much larger stature, unbranched culms, pubescent leaf sheaths, larger panicles, and upright leaf blades.

Panicum sect. *Dichotomiflora* A. Hitchc. & Chase ex Honda contains a widespread, annual-perennial species pair (*P. dichotomiflorum* Michaux–*P. aquaticum*) that has often been treated as a single species (e.g., Reeder & Reeder, 1971; Renvoize, 1984). We recognize the two taxa at the species level because of the difference in life form and because *P. aquaticum* has a functional male flower in the lower floret. This male flower is lacking in *P. dichotomiflorum*, even in plants in which the lower palea is fully developed. As Hitchcock & Chase (1910) noted many years ago, the lower palea of *P. dichotomiflorum* may be completely absent to fully developed.

The new variety seems to have a relationship with *P. aquaticum* var. *aquaticum* equivalent to that of *P. dichotomiflorum* var. *bartowense* (Scribner & Merr.) Fern. with variety *dichotomiflorum*, with the outstanding differences of both of the nontypical varieties being the unbranched culms and pubescent sheaths.

Variety *cartagoense* is an octoploid with $n = 36$, as is variety *aquaticum* (Davidse & Pohl, 1974, reported as *P. aquaticum*). The varietal name is based on the name of the province in which it was collected.

The recognition of *Dichanthelium* (A. Hitchc. & Chase) Gould as a segregate genus from *Panicum* L. continues to be controversial. Nevertheless, it seems likely that, despite a relatively uniform spikelet structure, *Panicum* as recognized in the broad

sense by Zuloaga (1987) and Clayton & Renvoize (1986) is polyphyletic, since elements included in *Panicum* sens. lat. are probably more closely related to other segregate genera now generally recognized. Under these circumstances narrow generic concepts seem prudent. Most of the combinations for Mesoamerican species of *Dichanthelium* are already available from the work of Hansen & Wunderlin (1988), Gould (1974, 1980b), and Gould & Clark (1978). The few additional ones not yet available are made here:

Dichanthelium sphaerocarpon (Elliott) Gould var. **floridanum** (Vasey) Davidse, comb. nov. Basionym: *Panicum sphaerocarpon* Elliott var. *floridanum* Vasey, U.S.D.A. Div. Bot. Bull. 8: 33. 1889. *P. erectifolium* Nash, Bull. Torrey Bot. Club 23: 148. 1896, nom. nov. for *P. floridanum* (Vasey) Chapman, Fl. South. U.S. (ed. 3) 585. 1897, non Trin. 1835. *Dichanthelium erectifolium* (Nash) Gould & C. A. Clark, Ann. Missouri Bot. Gard. 65: 1105. 1979. TYPE: United States. Florida: Mosquito Inlet, moist pine barrens, 5 May 1879, *Curtiss 3599* (lectotype, selected by Hitchcock & Chase (1910), US; isolectotype, MO).

Dichanthelium erectifolium was distinguished from *D. sphaerocarpon* by Gould & Clark (1978), following Hitchcock & Chase (1910), by its smaller spikelets (1.0–1.1 vs. 1.4–2.0 mm long). Hitchcock & Chase (1910) additionally noted differences in growth habit, blade nervation, and panicle size. However, reexamination of specimens throughout the range (including *D. sphaerocarpon* var. *isophyllum* (Scribner) Gould & C. A. Clark, *P. polyanthes* Schultes) shows a complete intergradation in habit, inflorescence size, and spikelet size. However, plants traditionally referred to *D. erectifolium* have modally smaller spikelets, 1.2 versus 1.5 mm, suggesting that varietal status is appropriate. As suggested by the specific epithet, the leaves of variety *floridanum* tend to be erect and appressed to the culm, and they also have a more clearly defined ligule, a ciliolate rim 0.3–0.4 mm long. The characters that distinguish variety *floridanum* are nearly equivalent to those that distinguish variety *isophyllum* from variety *sphaerocarpon*, as was done by Gould & Clark (1978).

Dichanthelium sciurotoides (Zuloaga & Morrone) Davidse, comb. nov. Basionym: *Panicum sciurotoides* Zuloaga & Morrone, Novon 1: 1. 1991. TYPE: Brazil. Minas Gerais: Districto Diamantina, Christais, near Corriga Duas Pontes, on damp earth in shade, common, 1,160 m, 13 May 1931, *Mexía 5819* (holotype, MO; isotypes, G, K, M, P, R).

Dichanthelium sciurotis (Trin.) Davidse, comb. nov. *Panicum sciurotis* Trin., Gram. Panic. 228. 1826. TYPE: Brazil. *Chamisso s.n.* (holotype, LE).

Zuloaga & Morrone (1991) recently clarified the status of the above two species. Mesoamerican plants of *D. sciurotoides* have previously been misidentified as *D. viscidellum* (Scribner) Gould and as *Dichanthelium sciurotis* Trin. The latter is a rare, narrowly restricted species from northeastern Brazil (Zuloaga & Morrone, 1991). *Dichanthelium sciurotoides* is so far known only from Belize, Bolivia, Brazil, Ecuador, French Guiana, Guyana, Panama, and Venezuela. *Dichanthelium viscidellum* ranges from southern Mexico throughout Mesoamerica to Colombia and Venezuela. The three species may be distinguished as follows:

1a. Lower glume nerveless, truncate; lower lemma inflated at the base ..... *D. sciurotis*
1b. Lower glume 1–3(–7)-nerved, acute to subacute.
  2a. Ligule with the membrane always longer than the minute cilia; spikelets glabrous ..... *D. sciurotoides*
  2b. Ligule with the cilia always longer than the minute rudimentary membrane; spikelets usually at least sparsely, marginally puberulent, rarely glabrous, often densely puberulent ..... *D. viscidellum*

Dichanthelium aciculare (Desv. ex Poiret) Gould & C. A. Clark var. **ramosum** (Griseb.) Davidse, comb. nov. Basionym: *Panicum neuranthum* Griseb. var. *ramosum* Griseb., Cat. Pl. Cub. 232. 1866. TYPE: Cuba occ., *Wright 3454* (holotype, GOET).

The element of *D. aciculare* traditionally known as *Panicum fusiforme* A. Hitchc. (Hitchcock & Chase, 1910), which has large, acute spikelets with a long-attenuate base, seems modally distinct from the rest of the species, especially in Mesoamerica, although there is some intergradation. This kind of variation is best recognized at the varietal rank.

Dichanthelium dichotomum (L.) Gould var. **unciphyllum** (Trin.) Davidse, comb. nov. Basionym: *Panicum unciphyllum* Trin., Gram. Panic. 242. 1826, and the autonym created by *P. unciphyllum* Trin. var. *implicatum* (Scribner) Scribner & Merr., Rhodora 3: 123. 1901. TYPE: United States. *Trattinick s.n.*

(lectotype, selected by Hitchcock & Chase (1910), LE).

Panicum tenue Muhlenb., Descr. Gram. 118. 1817. *Dichanthelium dichotomum* (L.) Gould var. *tenue* (Muhlenb.) Gould & C. A. Clark, Ann. Missouri Bot. Gard. 65: 1119. 1979. TYPE: United States. *Muhlenberg Herb. 192* (holotype, PH-M, fragment, US).

As pointed out by Hansen & Wunderlin (1988), *unciphyllum* is an earlier varietal epithet. Although they include this variety in *Dichanthelium ensifolium* (Baldwin ex Elliott) Gould, I agree with Gould & Clark (1978) that because of more numerous elongated culm internodes, it is best considered a part of *D. dichotomum*.

Dichanthelium umbonulatum (Swallen) Davidse, comb. nov. Basionym: *Panicum umbonulatum* Swallen, Contr. U.S. Natl. Herb. 29: 420. 1950. TYPE: Guatemala. Zacapa: upper slopes of Sierra de Las Minas, along Río Repollal, 2,100–2,400 m, 12–13 Jan. 1942, *Steyermark 42469* (holotype, US; isotype, F).

Panicum ramiparum Swallen, Contr. U.S. Natl. Herb. 29: 423. 1950, syn. nov. TYPE: Guatemala. Quetzaltenango: mountains near Santa María, S of Quetzaltenango, 25 Mar. 1932, *Weatherwax 160* (holotype, US).

Panicum alcobense Swallen, Contr. U.S. Natl. Herb. 29: 423. 1950, syn. nov. TYPE: Guatemala. Jalapa: oak wood around top of Cerro Alcoba, just E of Jalapa, 1,700 m, 2 Dec. 1939, *Steyermark 32515* (holotype, US; isotype, F).

Panicum alsophilum Swallen, Contr. U.S. Natl. Herb. 29: 422. 1950, syn. nov. TYPE: Guatemala. Jalapa: in oak woods around the top of Cerro Alcoba, just E of Jalapa, 1,700 m, 2 Dec. 1939, *Steyermark 32513* (holotype, F).

Dichanthelium umbonulatum is closely related to *D. commutatum* (Schultes) Gould sens. lat., including *D. albomaculatum* (Scribner) Gould, syn. nov., but differs in its glabrous spikelets and leaves with a prominent line of hairs at the base of the blade near the throat of the sheath; it also tends to have smaller leaf blades. The tip of the upper lemma is umbonate with a distinct, nearly herbaceous, protuberance. This is also true in *D. commutatum* in Mexico, Mesoamerica, and the southern United States but gradually becomes less pronounced northward in the United States. *Panicum ramiparum* is a form of *D. umbonulatum* with broad, pubescent leaves, and *P. alcobense* is a form with slightly smaller leaf blades. Although Swallen (1950) also noted that *P. alcobense* has the upper glume and lower lemma shorter than the upper floret, *D. umbonulatum* is variable in this regard and this character is not useful for separating these taxa. Finally, *Panicum alsophilum* is a form with the spikelets less densely arranged in the panicle.

Dichanthelium cordovense (Fourn.) Davidse, comb. nov. Basionym: *Panicum cordovense* Fourn., Mexic. Pl. 2: 26. 1886. TYPE: Mexico. Cordova, *Schaffner 293* (holotype, P, fragments, BAA, US).

Dichanthelium pantrichum (Hackel) Davidse, comb. nov. Basionym: *Panicum pantrichum* Hackel, Verh. K.K. Zool.-Bot. Ges. Wien 65: 72. 1915. TYPE: Brazil. Rio Grande do Sul: Mun. Rio Pardo, Fazenda Leitão, 70 m, Feb. 1909, *Jürgens s.n.* (holotype, W, fragment, US).

Typical species of *Setaria* P. Beauv. are well characterized by the possession of dense, cylindrical panicles with the spikelets borne in disordered fascicles on the main rachis or on the primary branches and flat, nonplicate leaf blades. In the majority of cases, each spikelet is subtended by one to several sterile branches or bristles. Another group of species has but a single bristle borne below the terminal spikelet of each branch. Such species were assigned by Hitchcock & Chase (1910) to *Panicum* subg. *Paurochaetium* A. Hitchc. & Chase and more recently by Pilger (1940: 72) to *Setaria* sect. *Paurochaetium* (A. Hitchc. & Chase) Pilger. Rominger (1962) noted that these species do not constitute a natural group, and his observation is substantiated by the anomalous structure of the inflorescence and spikelets in *S. chapmanii* (Vasey) Pilger. In this species, the slender inflorescence is made up of a number of unilateral spikes. The spikelets are biseriate and turned with the blunt first glume turned away from the rachis and the back of the fertile lemma toward it. The end of the rachis of the spike is a triquetrous extension beyond the terminal spikelet. This has led to the inclusion of this species in *Setaria* sect. *Paurochaetium*, but the neat arrangement of the spikelets in unilateral spikes is highly anomalous in that genus. The nature of the inflorescence indicates that this species is better accommodated in *Paspalidium* Stapf, characterized by spikelets borne in unilateral spikes and oriented with the back of the upper lemma turned regularly toward the rachis. *Paspalidium* with about 30 species is pantropical with its greatest center of speciation in Australia. The other Mesoamerican species of *Paspalidium*, *P. geminatum* (Forsskal) Stapf, is aquatic and has thick, spongy culms, while *P. chapmanii* is an inhabitant of more temporary pools and marshes on limestone, coral, and sand, with more slender culms.

As already noted by Rominger (1962), the remaining species in subgenus *Paurochaetium* fall into a primarily West Indian–Floridian group of six species, and a mainland group of three species centered in Texas and northern Mexico, with a fourth species from the Yucatan Peninsula. Although the arrangement of the spikelets in the West Indian species is less neat than in *P. chapmanii*, it nevertheless corresponds quite closely to the type of inflorescence structure found in certain Australian species of *Paspalidium*, such as *P. clementii* (Domin) C. E. Hubb., *P. constrictum* (Domin) C. E. Hubb., *P. criniforme* S. T. Blake, and *P. grandispiculatum* B. Simon. For this reason we take the opportunity here to transfer these species to *Paspalidium*. This relationship was also hinted at by Clayton & Renvoize (1986). We prefer to maintain the mainland group in *Setaria*.

Paspalidium chapmanii (Vasey) R. Pohl, comb. nov. Basionym: *Panicum chapmanii* Vasey, Bull. Torrey Bot. Club 11: 61. 1884, as *P. "chapmani."* *Setaria chapmanii* (Vasey) Pilger, Nat. Pflanzenfam. (ed. 2) 14e: 72. 1940. TYPE: United States. Florida: *Chapman s.n.* (lectotype, selected by Hitchcock & Chase (1910), US).

Paspalidium distantiflorum (A. Rich.) Davidse & R. Pohl, comb. nov. Basionym: *Panicum distantiflorum* A. Rich. in Sagra, Hist. Fis. Cuba, Bot. 11: 302. 1850. *Setaria distantiflora* (A. Rich.) Pilger, Nat. Pflanzenfam. (ed. 2) 14e: 72. 1940. TYPE: In montosis insulae Cubae, *Sagra s.n.* (holotype, P).

Paspalidium leonis (E. Ekman) Davidse & R. Pohl, comb. nov. Basionym: *Panicum leonis* E. Ekman in A. Hitchc., Man. Grasses W. Ind. 295. 1936. TYPE: Cuba. Cojimar, near Habana, in fruticetis littoralibus, 9 Sep. 1921, *Ekman 13155* (holotype, US).

Paspalidium ophiticola (A. Hitchc. & E. Ekman) Davidse & R. Pohl, comb. nov. Basionym: *Panicum ophiticola* A. Hitchc. & E. Ekman in A. Hitchc., Man. Grasses W. Ind. 293. 1936. *Setaria ophiticola* (A. Hitchc. & E. Ekman) Sauget-Barb., Contr. Ocas. Mus. Hist. Nat. Colegio "De La Salle" 8: 163. 1946. TYPE: Cuba. Pinar del Río: Loma Cajálbana, in cuables, on serpentine, 2 Jan. 1921, *Ekman 12712* (holotype, US).

Paspalidium pradanum (Sauget-Barb.) Davidse & R. Pohl, comb. nov. Basionym: *Panicum pradanum* Sauget-Barb. in A. Hitchc., Man. Grasses W. Ind. 294. 1936. *Setaria pradana* (Sauget-Barb.) Sauget-Barb., Contr. Ocas. Mus. Hist. Nat. Colegio "De La Salle" 8: 164. 1946. TYPE: Cuba. Oriente: in open thickets on slope of Mesa de Prada, lower Jauco Valley, Jauco, 17 July–4 Aug. 1924, *Léon 11710* (holotype, US).

Paspalidium subtransiens (A. Hitchc. & E. Ekman) Davidse & R. Pohl, comb. nov. Basionym: *Setaria subtransiens* A. Hitchc. & E. Ekman in A. Hitchc., Man. Grasses W. Ind. 351. 1936. TYPE: Cuba. Santa Clara: in thickets on serpentine, Motembo, 27 June 1923, *Ekman 16828* (holotype, US).

Paspalidium utowanaeum (Scribner) Davidse & R. Pohl, comb. nov. Basionym: *Panicum utowanaeum* Scribner, Publ. Field Columbian Mus., Bot. Ser. 2: 25. 1900. *Setaria utowanaea* (Scribner) Pilger, Nat. Pflanzenfam. (ed. 2) 14e: 72. 1940. TYPE: Puerto Rico. From a dry hillside near Guánica, 22 Jan. 1899, *Millspaugh 702* (holotype, F).

PANICEAE: DIGITARIINAE

Digitaria breedlovei R. Pohl & Davidse, sp. nov. TYPE: Mexico. Chiapas: Municipio de Villa Corzo, 65 km S of Mexican Highway 190 on road from Tuxtla Gutiérrez to Nueva Concordia, steep canyon with seasonal evergreen forest and slopes of *Quercus*, elev. 850 m, 12 Sep. 1974, *D. E. Breedlove 37709* (holotype, MO; isotypes, CAS, MEXU). Figure 8.

Digitaria spiculis ternatis gluma prima absenti, gluma secunda obsoleta vel minuta, usque ad 0.4 mm longa, lemmate fertili brunneolo vel castaneo, rhachidi triquetra, hirsuta.

Caespitose, annual herb. Culms 25–50 cm long, branching from the base; internodes glabrous. Leaves with the sheaths and blades densely papillose-hirsute; ligule 0.7–1 mm long, membranous, truncate; blades 4–10 cm long, 2–3 mm wide, linear, flat. Inflorescences 6–12 cm long, terminal; peduncles exserted for 6–8 cm; rachis of the inflorescence short; racemes 4–5, 6–8 cm long, slender, ascending; rachis of the racemes 0.2–0.3 mm wide, triquetrous, bearing conspicuous hairs 1–2 mm long; pedicels scabrous, unequal, the longest 1.3–1.5 mm long. Spikelets 1.3–1.5 mm long, in triads, acute; lower glume absent; upper glume 0–0.4 mm long, a hyaline scale when present; lower lemma narrower and shorter than the upper, 5-nerved, sparsely appressed-pubescent, the hairs with dilated tips; upper lemma tan to light brown, minutely striate; stamens 3, the anthers ca. 0.5 mm; pollen and caryopses developing.

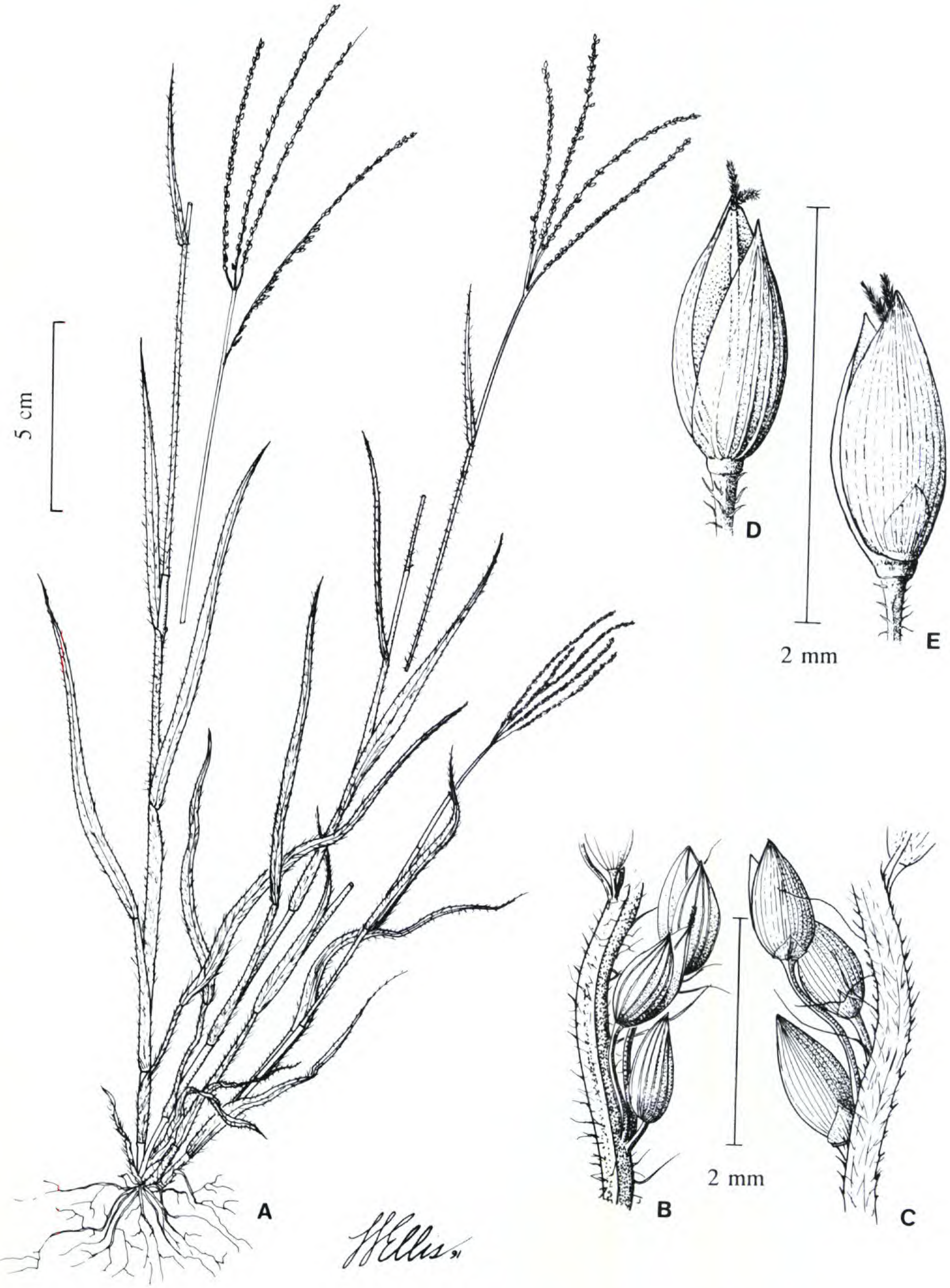

Figure 8. *Digitaria breedlovei* R. Pohl & Davidse. —A. Habit. —B, C. Two views of a rachis segment with a spikelet triad. D, E. Spikelet. —D. Ventral view showing upper lemma. —E. Dorsal view showing small hyaline lower upper glume and back of upper floret. (Based on *Breedlove 37709.*)

This species is known only from the type collection. It is distinguishable from other American species with ternate spikelets by the minute, hyaline upper glume and the conspicuously hirsute rachis.

This species is named in honor of Dennis E. Breedlove, California Academy of Science, in recognition of his outstanding contributions to Mexican botany, especially his work on the *Flora of Chiapas.*

Digitaria clavitricha R. Pohl, sp. nov. TYPE: Panama. Colón: Chorrera, prairie, especially on dry or gravelly places, 16 Sep. 1911, *A. S. Hitchcock, Amer. Grasses Natl. Herb. 1564* (holotype, MO; isotype, US) [also distributed as *A. S. Hitchcock 8149* (US)].

Digitaria ad sectionem *Corynotrichas* Henrard pertinens. Gramen perenne. Inflorescencia ex racemis 1–2 constans. Spiculae ternatae, late ellipticae, 1.8–1.9 mm longae, 0.9-1.1 mm latae; gluma prima minuta, truncata; gluma secunda truncata, 1.5–1.7 mm longa; lemmate infero spiculam aequanti; gluma secunda et lemmate infero pilis minutis clavatis obsitis; lemmate supero badio.

Caespitose, perennial herb. Culms 30–90 cm long; internodes glabrous; nodes papillose-hirsute, especially the lower ones. Leaves with the sheaths papillose-hirsute; ligules ca. 0.5 mm long, membranous; blades 6–24 cm long, 2–3 mm wide, glabrous except for a few elongated trichomes near the adaxial base. Inflorescence 2–7 cm long, of 1–2 racemes 2–4 cm long. Spikelets 1.8–1.9 mm long, 0.9–1.1 mm wide, broadly elliptic, in triads; lower glume a minute, nerveless, hyaline cuff 0.05–0.15 mm long; upper glume 1.5–1.7 mm long, broad, blunt, 3-nerved; lower lemma as long as the spikelet, 5–7-nerved; upper glume and lower lemma beset with clavate hairs ca. 0.3 mm long and dilated nearly to their bases; upper lemma dark brown; stamens 3, the anthers ca. 0.9 mm long; styles purple.

Paratype. PANAMA. CANAL ZONE: between Panama and Corozal, prairie, 20–50 m, 17 Dec. 1911, *Hitchcock 9196* (US).

This species is only known from grasslands in central Panama at low elevations. It belongs to Henrard's (1950) section *Corynotrichae*, which is characterized by minute balloon-shaped hairs. The epithet of the new species refers to this type of hair. All previously known species of this section are from South America. It differs from its closest ally, *D. venezuelae* Henrard, in the presence of a lower glume and in the shorter upper glume. Swallen (1943: 170) identified the two cited specimens as *D. singularis* Mez, a species described from Paraguay and also known from Argentina (Rúgolo de Agrasar, 1974). However, *D. clavitricha* differs from *D. singularis*, in its much smaller spikelets and nonprotruding fertile floret.

ANDROPOGONEAE

Andropogon gerardii Vitman var. **hondurensis** R. Pohl, var. nov. TYPE: Honduras. Road to Teupasenti, open pine forest, 1,350 m, 22 June 1980, *R. W. Pohl & L. G. Clark 14011* (holotype, ISC).

A var. *gerardii* culmis gracilibus brevibusque, spiculis sessilibus brevioribus ca. 5–5.3 mm longis, gluma inferiore plana esulcata recedit.

Caespitose, perennial herb with short, thick rhizomes. Culms 70–200 cm long. Leaves mostly basal, glabrous except for a tuft of hairs in the ligular area; ligule 1.0–2.5 mm, a ciliolate membrane; blades to 50 cm long, 3.0–5.5 mm wide, folded or flat, the tip acute. Inflorescences several, scarcely overlapping; spathes narrow; racemes 1–3 per peduncle, 3–8 cm long, ascending, sparsely pubescent with hairs 2.0–3.5(–4.0) mm long; rachis internodes clavate, flat. Sessile spikelets 5.0–5.3 mm long; callus oblique, pilose with hairs 0.5–2.5 mm long; glumes awnless, the lower flat, several-nerved between the keels, coriaceous; awn of the upper lemma exserted to 11 mm, twisted in the lower ½, geniculate; stamens 3, the anthers 1.0–1.2 mm long; pedicellate spikelets 5–7 mm long, acute, the flower absent or staminate; stamens 3 when present, the anthers to 2.4 mm long. $2n = 80$.

Representative paratypes. BELIZE. EL CAYO: Mountain Pine Ridge, July–Aug. 1936, *Lundell 6791* (F). HONDURAS. COMAYAGUA: vic. of Siguatepeque, 4 July 1936, *Yuncker et al. 5641* (MO); 10 km E of Siguatepeque, 17 June 1980, *Pohl & Clark 13988* (ISC). DISTRITO CENTRAL: El Hatillo, *Pohl & Gabel 13794* (ISC). EL PARAÍSO: Güinope, 25 Oct. 1951, *Swallen 11105* (ISC); 22 km W of Danlí, 21 July 1970, *Pohl & Davidse 12400* (MO). FRANCISCO MORAZÁN: 4 km N of La Venta, 20 June 1970, *Pohl & Davidse 12031* (ISC); Las Mesas, 15 Oct. 1951, *Swallen 10762* (ISC). INTIBUCA: La Esperanza, 12 Sep. 1981, *Segovia 101* (MO); 8 km SW de Masaguara, 6 June 1985, *Téllez V. & Martínez S. 8675* (MO). COSTA RICA. GUANACASTE: SE slopes of Volcán Santa María, 27–28 Jan. 1983, *Davidse et al. 23331* (MO).

Plants of variety *hondurensis* are especially common, but scattered, in the open pine forests of central Honduras, and this is the basis for the epithet. They have been collected at elevations of 800–2,000 m.

Andropogon gerardii var. *hondurensis* in Mesoamerica is smaller and more gracile than the typical variety encountered in the United States. The Mesoamerican plants also differ from the North American plants in having shorter sessile spikelets, averaging ca. 5 mm long, whereas plants in the temperate United States usually have spikelets 7–10 mm long. Lower glumes of the sessile spikelets of the Mesoamerican plants are flat, while those from the United States are sulcate. Although various ploidy levels for this species are known, the Honduran plants, so far as known, are octoploid, $2n = 80$, (Davidse & Pohl, 1972, as *A. gerardii*).

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Merostachys burmanii (Poaceae: Bambusoideae: Bambuseae), a New Species from Brazil

Tatiana Sendulsky
Herbário, Instituto de Botânica, Caixa Postal 4005,
01061 São Paulo, São Paulo, Brazil

ABSTRACT. *Merostachys burmannii*, a new species from Brazil, is described and illustrated.

The South American genus *Merostachys* (Poaceae: Bambusoideae: Bambuseae) comprises approximately 40 species and has a center of diversity in Brazil. The first attempt to recognize and order the species in this genus was made by McClure (1973), who listed ca. 25 species. During fieldwork and herbarium studies aimed at completing a revision of this genus, several new species have been discovered, one of which is described and illustrated here.

Taxonomic understanding of genus *Merostachys* has grown slowly. This is due to the long interval between flowering cycles—some 30–33 years—and to the difficulties in bringing together the rare collections. Because of long-standing diversity of opinion regarding interpretation of the spikelet morphology in the genus, a well-founded and adequate terminology for bamboo descriptions is under investigation. For now, the most suitable terms from standard grass taxonomy are used.

Merostachys burmanii Sendulsky, sp. nov. TYPE: Brazil. São Paulo, Jardim Botânico, 25 Mar. 1944 (fl), *Kuhlmann s.n.* (holotype, SP sheet no. 79757; isotype, US sheet no 2678539). Figure 1.

Culmi praeter apices flexuosos erecti, 10–15 m alti, ca. 4 cm diametro; internodiis fistulosis, luteis vel fusco-viridibus plerumque laevibus, nonnumquam scabris, aculeis retrorsis, acutisque; nodis prominentibus, fuscis; culmo sub nodo pilis albidis adpressis interdum cera mixtis vestito. Folia culmi vagina ca. 30 cm longa, 10 cm lata, ad apicem asymmetrica, rotundata, fimbriata, setis ca. 0.5 mm longis; lamina reflexa, ca. 17 cm longa, 18–20 mm lata, acuminatissima. Rami verticillati, in complemento 100–130, usque ad 65 cm longi, 1–2 mm diametro, teretes, laeves, glabri. Folia ramorum in complemento 7–9; vagina glabra, setis oralibus caducis, 2–3 mm longis; lamina 15–17 cm longa, 2–3 cm lata, lineari-lanceolata, glabra, apice acuminata. Inflorescentia spiciformis, non pectinata, 8–11 cm longa, erecta, rami ad apicem disposita; spiculis saepe deflexis, plerumque binatis, interdum solitariis, rarissime ternatis. Caryopsis oblonga, ovoidea, asymmetrica, rostrata, luteo-castanea, laevis, 6–7 mm longa, 2–2.5 mm lata.

Culms 10–15 m long, ca. 4 cm diam., erect except at flexuous tips, the slender young culms strongly and retrorsely scabrous. *Internodes* 38–40 cm long, terete, fistulose, dark yellow or greenish, mostly smooth and shiny, though otherwise smooth culms may display strongly scabrous areas with retrorse, sharp, hooklike prickle hairs; culm walls weak, 1–3 mm thick. *Nodes* salient, dark, with a layer of velvety whitish hairs below, hairs and wax sometimes mixed together. *Culm leaves* caducous: sheaths ca. 28–30 cm long, 10 cm wide, rounded and asymmetrical at the summit, fringed at the apex only with fine hairs, these ca. 0.5 mm long; margins smooth and shiny along the adaxial surface, membranous, without cilia; abaxial surface nearly glabrous at the base, retrorsely scabrous at the apex, the adaxial surface shiny; inner ligule a fine membrane, ciliolate on margin, 1–2 mm long, wider in the middle; outer ligule a salient rim; blades reflexed, ca. 17 cm long, 18–20 mm wide, strongly nerved, gradually attenuate to a fine point. *Branch complement* with 100–130 branches (200–300 *fide* Soderstrom), these up to 50–65 cm long, 1–2 mm thick, yellowish, smooth, glabrous, shiny, the internodes ca. 17 cm long, 2–3(–5)-noded before the leaves, nodes usually black, sometimes dark yellow, prominent. *Foliage leaves* 7–9 per complement, the lower well developed, distant below; sheaths tight, glabrous, adaxial surface smooth, densely dark-spotted; oral setae caducous, 2–3 mm long, whitish, diminishing in size downward along the upper margin of the sheath; inner ligule arcuate, ca. 1 mm long, coriaceous, minutely ciliolate on the margin; outer ligule a salient, glabrous rim; pseudopetiole flat, dark, glabrous, 4 mm long; blades 15–17 cm long, 2–3 cm wide, linear-lanceolate, asymmetrical, gradually attenuate toward the apex, glabrous on both surfaces, the adaxial surface sometimes with 2–3 marginal nerves on one side with rows of very fine prickle hairs, the margins and the apex finely scabrous. *Inflorescence* terminal on a leafy branch, spicate, not pectinate, erect, 8–11 cm long, ca. 2 cm wide, bearing secund, mostly deflexed, laterally outspread, paired spikelets. Peduncle of the inflorescence densely and retrorsely scabrid. Rachis sinuous, longitudinally

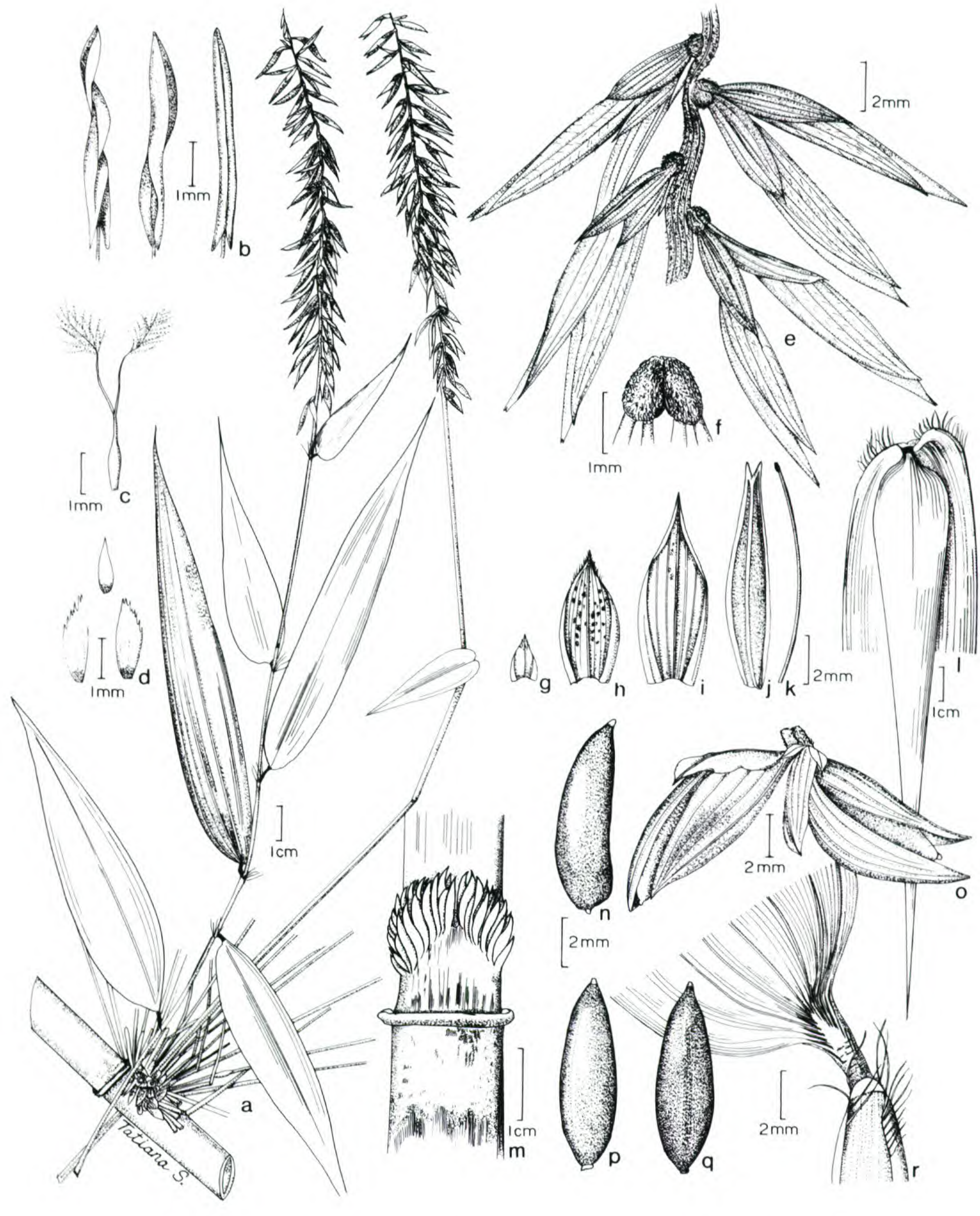

Figure 1. *Merostachys burmanii* Sendulsky. —a. Flowering branches and part of a branch complement. —b. Old, empty anthers. —c. Gynoecium. —d. Lodicules. —e. Part of the inflorescence: rachis and paired spikelets. —f. Pedicels. —g. Lower glume. —h. Upper glume. —i. Lemma. —j. Palea. —k. Prolongation of rachilla. —l. Culm leaf. —m. Branch bud in development. —n. Caryopsis, lateral view. —o. Pair of spikelets with mature caryopses. —p. Caryopsis, embryo view. —q. Caryopsis, hilum view. —r. Upper portion of the sheath, ligule, and base of a foliage leaf. All illustrations based on *Kuhlmann s.n.* (SP sheet no. 79757) except "l" and "m," based on *Toledo s.n.* (SP sheet no. 238492).

deeply ridged, puberulous to villous, the hairs white. *Spikelets* in pairs, sometimes solitary, very rarely ternate, frequently one of a pair of spikelets depauperate or rudimentary. Normal spikelet 1-flowered, hermaphrodite, 8–11 mm long, 2 mm wide, narrowly fusiform when young, becoming thicker and shorter when mature. Pedicels adnate, thick, pubescent. *Glumes* 2, unequal. *Lower glume* triangular, 2 mm long, 1.5 mm wide at the base, acuminate toward the apex, 1-nerved, abaxially sparsely hirsute along the nerve, adaxially puberulous near the apex, the hairs white. *Upper glume* 5 mm long, 3.5 mm wide, broadly lanceolate, slightly asymmetrical, carinate, marginally ciliate toward the apex, 5–7-nerved, the nerves anastomosing, the adaxial surface densely dark-spotted. *Lemma* 8 mm long, 3.5–4 mm wide, carinate, broadly lanceolate, slightly curved, fully embracing the palea at the base, slightly asymmetrical, 10–11-nerved, the nerves anastomosing, the adaxial surface dark-spotted. *Palea* fusiform, curved, bifid, 2-keeled, narrowly sulcate abaxially, 6-nerved, the nerves anastomosing in upper part, the keels finely and sparsely denticulate. Prolongation of the rachilla bristlelike, as long as the palea, finely pubescent and bearing a minute rudiment. *Lodicules* 3, subequal, ca. 2 mm long, finely ciliate at the apex. Stamens 3, the anthers 6 mm long, 0.5 mm wide, somewhat twisted in later stages. Stigmas 2, ca. 4 mm long, plumose. Mature *caryopsis* 6–7 mm long, 2–2.5 mm wide, oblong, ovoid, asymmetrical, rostrate, dark yellow or brown, smooth, shiny, with thin, coriaceous pericarp, the embryo and the hilum not manifest externally.

Phenology. This species has been collected in flower in 1915, in the periods between 1944 and 1948 and between 1972 and 1978(–1980).

Distribution. Brazil, states of Bahia, Rio de Janeiro and São Paulo, at (400–)600–1,600 m above sea level.

Paratypes. BRAZIL. BAHIA: Jaguaquara, km 30 da rodovia Jaguaquara–Apuerema, 25 Oct. 1972 (fl), *Pinheiro s.n.* (US). RIO DE JANEIRO: Serra dos Orgãos, Parque Nacional, km 4, 7 July 1947 (fl), *Occhisni 1046* (US); Serra dos Orgãos, 16 km S of Itaipara, 950 m, 26 Mar. 1976 (fr), *Davidse et al. 11419* (NY, US); Serra dos Orgãos, Fazenda Dr. Portugal, 1,400 m, 27 Nov. 1948 (fl), *Brade 19457* (SP); Organ Mountains, 12 Aug. 1915 (fr), *Rose & Russel 20768* (NY, RB, US); Orgelgeberge, 1,400–1,600 m, May 1915, *Luetzelburg 6255* (NY); Serra dos Orgãos, Nova Friburgo, road to television tower, 1,350 m, 14 Mar. 1980 (fl—abnormal late growth), *Burman & Soderstrom 525* (US); Campo Grande, Serra do Mendanha, 600–700 m, 4 Apr. 1978 (fl), *Martinelli et al. 4129* (RB,SP); Tijuca, Parque Nacional, Mesa do Imperador, ca. 20°50′S, 43°20′W, 400–650 m, 21 Oct. 1977 (fl), *Landrum 2031* (RB). SÃO PAULO: Jardim Botânico, 19 Jan. 1944 (fl), *Toledo s.n.* (SP sheet 50362, US sheets 2678540, 2900180, 2921684), 19 May 1959 (st), *Toledo s.n.* (SP sheet 238492), 23 Mar. 1944 (fr), *Gert & Kuhlmann s.n.* (SP sheet 50462).

Only three of the 40 or so known species of *Merostachys*, described and undescribed, bear spikelets in clusters on the inflorescence spikes: in *Merostachys* sp. indet. (Pohl, 1980) and *M. burmanii*, the spikelets are paired, and in *M. ternata* Nees they are grouped in threes, thus the specific name. *Merostachys ternata* is further distinguished by its large spikelets (up to 14 mm long) and the size of its leaves (35–50 cm long, up to 10 cm broad). Thus, *M. burmanii* bears a close resemblance only to the species described, but not named, by Pohl from Costa Rica: it may be distinguished from the latter by its inflorescence, 8–11 cm long, with deflexed, nonpectinate, laterally outspread spikelets. The inflorescence of Pohl's species is 4.5–6.5 cm long, with spikelets appearing to form a single pectinate rank.

Burman & Soderstrom 525 is an unusual form of *M. burmanii*, with occasionally 2 or 3 florets (rather than 1) per spikelet. Exceptionally, under the stress of late growth, when other plants have already flowered and died in the region, a few plants may tardily produce new shoots bearing late spikelets. Some of these spikelets may be abnormal, with 2 or 3 florets each, sustained one above the other by a continuous upward development of the rachilla. As it represents an abnormal form, the collection cannot be chosen as the holotype and has been replaced by another, more representative collection.

This species is named for Alasdair G. Burman, colleague and friend, who dedicates much of his time to studying South American bamboos. It was he, who, in 1980, in the Serra dos Orgãos, State of Rio de Janeiro, Brazil, collected this species in the company of the late Thomas R. Soderstrom, who on that occasion had the intention of naming it for him.

Acknowledgments. I thank the Conselho Nacional de Desenvolvimento Científico e Tecnológico (CNPq) for a grant that has made this work possible. I also thank the staff of the U.S. National Herbarium, Smithsonian Institution, for assistance and for making their collections available for study, and the anonymous reviewers for critically reading the manuscript.

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Muhlenbergia cualensis and *M. michisensis* (Poaceae: Eragrostideae): Two New Species from Mexico

Yolanda Herrera A.
CIIDIR Unidad Durango, Instituto Politécnico Nacional,
Apartado Postal 738, Durango, Dgo., 34000 México

Paul M. Peterson
Department of Botany, National Museum of Natural History,
Smithsonian Institution, Washington, D.C. 20560, U.S.A.

ABSTRACT. *Muhlenbergia cualensis* from Jalisco, and *M. michisensis* from Durango, Mexico, are described and illustrated. A table distinguishing among the new species and related taxa is given.

The genus *Muhlenbergia* Schreber is represented in Mexico by at least 115 species, of which 47 percent are endemic (Beetle, 1987). Morphological characters that delimit the genus are spikelets with a single perfect floret and lemma usually with three prominent nerves. While collecting for a systematic study of *Muhlenbergia montana* (Nutt.) A. Hitchc. and related species in the Sierra Madre of Durango (Herrera, 1991), a morphologically distinct taxon was discovered. Later, during an examination of herbarium specimens, a second new taxon was found. The *Muhlenbergia montana* complex is a loose assemblage of caespitose, nonrhizomatous perennials of perhaps 12 species that usually have a dentate or 3-toothed second glume and an awned lemma. Members of this complex generally occur above 1,000 m in pine and oak forests from Montana to California and Texas, and extend southward into Mexico and Guatemala. These two new species and an accompanying table are presented prior to completion of the overall treatment of the *Muhlenbergia montana* complex, so others in Mexico may become aware of their existence and search for additional locations. The specific epithet of *M. cualensis* is derived from the Sierra el Cuale, the type locality, and the epithet of *M. michisensis* refers to the small village of San Juan de Michis where it was first collected.

Muhlenbergia cualensis Herrera & P. Peterson, sp. nov. TYPE: Mexico. Jalisco: SSE of Puerto Vallarta, 14 km from the opening of the Zimapán Mine, 1 km W of Providencia boundary El Tuito–El Cuale, 20°15′N, 105°15′W, 31 Jan. 1983, *R. Guzmán 6090* (holotype, COCA; isotypes, IBUG, US). Figure 1.

A *Muhlenbergia eriophylla* culmis altis 50–70 cm, ligulis 10–12 mm longis; laminis planis ad involuta supra hirsutula; paniculis 15–25 cm longis; lemmatibus (2.6–)2.8–3.0 mm longis, aristatis luteolis, recedit.

Densely caespitose perennial without rhizomes. Culms 50–70 cm tall, erect, rounded and branching near the base, puberulent just above the mostly basal nodes; internodes mostly glabrous. Sheaths 7–34 cm long, mostly longer than the lower internode, glabrous to scaberulous, stiff and papery below, usually folded; margins membranous. Ligules 10–12 mm long, membranous, hyaline, decurrent; apex acuminate, often lacerate. Blades (11–)20–25 cm long, 0.5–2 mm wide, flat to involute, apically acuminate, somewhat stiff, hirsutulous above and glabrous to scaberulous below. Panicles 15–25 cm long, 0.7–4 cm wide, narrow to somewhat open, loosely flowered, ascending branches mostly loosely appressed or spreading up to 35° from the culm axis; pedicels 0.6–3 mm long, flattened, ascending, scabrous to scaberulous; inflorescence branches 0.6–7 cm long; central axis with 4–6 ribs near base. Spikelets 3–4 mm long, erect, 1-flowered. Glumes (3–)3.5–4 mm long, oblong, longer than the lemma, usually equal in length, 1-nerved, olivaceous, short pilose near base and along nerve; apex acute to obtuse, occasionally minutely erose. Lemma (2.6–)2.8–3.0 mm long, oblong-lanceolate, awned, olivaceous; midnerve, margins, and proximal ⅓ to ¾ loosely to densely appressed pubescent to pilose, the hairs up to 0.4 mm long; apex acute to acuminate; the awn 16–20 mm long, yellow, flexuous to straight. Palea (2.6–)2.8–3.0 mm long, oblong, the proximal ⅔ loosely to densely appressed pubescent to pilose between the nerves; apex obtuse with an abruptly mucronate tip. Anthers 1.6–2.2 mm long, purple. Caryopsis not seen.

Figure 1. *Muhlenbergia cualensis* Herrera & P. Peterson, Jalisco, Mexico (*R. Guzman 6090*). —A. Habit. —B. Ligule. —C. Inflorescence. —D. Spikelet. —E. Glumes. —F. Lower glume, dorsal view. —G. Floret. —H. Lemma, dorsal view. —I. Lemma, ventral view. —J. Palea, dorsal view. —K. Palea enclosing the pistil and lodicules, ventral view. —L. Palea and stamens, lateral view.

Figure 2. *Muhlenbergia michisensis* Herrera & P. Peterson, Durango, Mexico (*Herrera & Acevedo 986*). —A. Habit. —B. Ligule. —C. Inflorescence. —D. Spikelet. —E. Glumes. —F. Lower glume, dorsal view. —G. Floret. —H. Lemma. —I. Palea, dorsal view. —J. Palea enclosing the stamens, pistil, and lodicules.

TABLE 1. Salient characters distinguishing *Muhlenbergia cualensis*, *M. durangensis*, *M. eriophylla*, *M. michisensis*, and *M. watsoniana*.

Characters	*M. cualensis*	*M. durangensis*	*M. eriophylla*	*M. michisensis*	*M. watsoniana*
Rhizomes	absent	present	absent	absent	absent
Ligule length (mm)	10–12	0.5–0.7(–1)	8–10	4–7	0.5–1
Adaxial blade surface	hirsutulous	scabrous	long villous	hirsute-glabrous	hirsutulous
Panicle length (cm)	15–25	10–25	4–13	12–17	4–12(–15)
Spikelet length (mm)	3–4	(5–)6–7(–7.5)	3.5–4	4.5–5	3–3.8
Glume length (mm)	(3–)3.5–4	(5–)6–7(–7.5)	3–4	4.5–5	3–4
Second glume shape	entire to erose	entire	dentate	entire	erose
Lemma length (mm)	(2.6–)2.8–3	5–6.7(–7)	3–3.5	3.5–4	2.5–3.3
Lemma awn	flexuous-straight	flexuous	straight	flexuous	flexuous
Lemma awn color	yellow	yellow	olive-green	purplish yellow	yellow
Anther length (mm)	1.6–2.2	(2.5–)3–3.5	1.8–2	2–2.4	1.7–2

Distribution and habitat. Muhlenbergia cualensis is known only from the area surrounding the Zimapán Mine at approximately 1,000 m in the mountains southeast of Puerto Vallarta. At this location *M. cualensis* occurs on sandy to sandy clay loam slopes with granitic stones in open forests of *Quercus* and *Pinus ayacahuite* Ehrenb.

Additional specimens examined. MEXICO. JALISCO: E of the Zimapán Mine, 31 Jan. 1983, *R. Guzmán 6100, 6101, 6102, 6104* (all COCA).

Muhlenbergia cualensis is morphologically very similar to *M. eriophylla* Swallen, which can be distinguished from the former by possessing culms 17–40 cm tall, ligules generally 8–10 mm long, leaf blades with large, silvery, densely appressed-villous, unicellular macrohairs that measure 0.1–0.2 mm wide and up to 4 mm long, panicles 4–13 cm long, and lemmas 3–3.5 mm long with olive-green awns (see Table 1). The leaf blade in transverse section of *M. cualensis* differs from *M. eriophylla* by having elliptical or vertically elongated primary (I°) vascular bundles that alternate between a single, smaller tertiary (III°) vascular bundle. In *M. eriophylla* the I° vascular bundles are circular or round in outline, and there are two vascular bundles, either secondary (II°), III°, or in combination, between each I° vascular bundle.

Muhlenbergia cualensis resembles *M. watsoniana* A. Hitchc., although the latter differs in a few morphological characteristics. Short ligules (0.5–1 mm long), folded leaf blades, and short, narrow panicles (4–12 cm long × 1–2 cm wide) are the most prominent features of *M. watsoniana*.

The flavonoid chemistry of *M. cualensis* is most similar to *M. flaviseta* Scribner and *M. virescens* (Kunth) Kunth by sharing the following compounds: quercetin 3-O glucoside with *M. virescens;* and luteolin 5-O glucoside, luteolin 6 arabinoside, luteolin 7-O galactoside, apigenin 6, 8 diglucoside (vitexin), apigenin 7-O arabinoside, tricin 5-O glucoside, tricin 7-O glucuronide, and 4′hydroxyflavone 7-O glucoside with both species (Herrera & Bain, 1991).

Muhlenbergia michisensis Herrera & P. Peterson, sp. nov. TYPE: Mexico. Durango: Municipio de Suchil, Las Escobas, San Juan de Michis, 23°24′N, 104°8′W, 17 Sep. 1989, *Herrera & Acevedo 986* (holotype, CIIDIR; isotypes, MTMG, US). Figure 2.

A *Muhlenbergia durangensis* rhizomate nullo; ligulis 4–7 mm longis; spiculis 4.5–5.0 mm longis; glumis 4.5–5.0 mm longis, glumis secundis 1-nervis vel 2-nervis; lemmatibus 3.5–4 mm longis; paleis 2.8–3.5 mm longis, apice 3-lobis; antheris 2–2.4 mm longis, recedit.

Densely caespitose perennial without rhizomes. Culms 68–80 cm tall, branching and rounded near base, glabrous just below the mostly basal nodes; internodes glabrous. Sheaths 8–14 cm long, mostly longer than the lower internode, scaberulous, becoming flattened and conspicuously spirally coiled below, loose and papery. Ligules 4–7 mm long, membranous, hyaline, decurrent; apex acuminate. Blades (8.5–)10–20 cm long, 1–3 mm wide, flat to folded or involute, scabrous below and glabrous to sparsely hirsute above. Panicles 12–17 cm long, 2–4 cm wide, open, loosely flowered, ascending branches mostly spreading 20–50° from the culm axis; pedicels 0.2–1 mm long, short and stout, scabrous to hispid; inflorescence branches 0.4–3 cm long; central axis triquetrous, 3–6-ribbed, scabrous. Spikelets 4.5–5.0 mm long, erect, tightly clustered or paired along each branch, 1-flowered. Glumes 4.5–5.0 mm long, oblanceolate, entire, longer than the lemma, usually equal in length, 1-nerved, oc-

casionally the second 2-nerved, olivaceous, scabrous along the entire length and usually short pilose near base and along midnerve; apex acute. Lemma 3.5–4.0 mm long, oblong-lanceolate, hyaline to yellowish, awned; midnerve and margins on the proximal ¾ appressed pubescent to pilose, the hairs to 0.3 mm long; apex acute, minutely bifid, the lobes to 0.2 mm long, the awn 10–15 mm long, flexuous, yellowish distally and purplish near base. Palea 2.8–3.5 mm long, oblanceolate, loosely appressed pubescent between the nerves on the proximal ⅕; apex 3-lobed to tridentate, the lateral lobes obtuse and the central lobe acute. Anthers 2–2.4 mm long, reddish purple. Caryopsis not seen.

Distribution and habitat. *Muhlenbergia michisensis* is known from southeastern Durango, southwest of Vicente Guerrero between 2,450 and 2,650 m. It occurs on rocky slopes in forests composed of *Quercus* and *Pinus*.

Additional specimens examined. MEXICO. DURANGO: Cerro Blanco, Reserva de la Biosfera "La Michilia," 17 Apr. 1986, *S. González 3740* (CIIDIR); San Juan de Michis (Potrero de Escobas), 23 Jan. 1986, *J. Alvarado, s.n.* (CIIDIR).

Muhlenbergia michisensis is morphologically similar to *M. durangensis* Herrera, which can be distinguished from the former by having short rhizomes; ligules 0.5–0.7(–1) mm long; spikelets (5–)6–7(–7.5) and glumes (5–)6–7(–7.5) mm long, the second 3-nerved; lemmas 5–6.5(–7) cm long with awns (10–)15–20(–25) mm long; paleas 5–6 mm long; and anthers (2.5–)3–3.5 cm long (Table 1).

The flavonoid chemistry of *M. michisensis* is most similar to *M. eriophylla* by sharing: quercitin 3-O rhamnosilxyloside, luteolin 6 galactoside, luteolin 6 glucoside, luteolin 8 glucoside, apigenin 6, 8 diglucoside (vitexin), apigenin 7-O arabinoside, apigenin 7-O diarabinoside, apigenin 7-O glucoside, tricin 5-O glucoside, tricin 7-O glucuronide, and 4′hydroxyflavone 7-O glucoside (Herrera & Bain, 1991).

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Leucoloma crosbyi (Dicranaceae), a New Species Endemic to Northern Madagascar

Catherine LaFarge-England
Cryptogamic Herbarium, Department of Botany, University of Alberta, Edmonton, Alberta T6G 2E9, Canada

ABSTRACT. *Leucoloma crosbyi*, a new species from northern Madagascar, is described, resulting from a revision of the pantropical genus. Diagnostic characters include: robust habit; narrow, opaque, juxtacostal bands tapering to basal region; costal-laminal transition zone with 2–9 multi- to bistratose rows; interior cells forming broad scarious region; narrow hyaline margin; and longitudinally thick-walled alar cells. It is most closely related to *L. grandidieri* Ren. & Card. and has been confused with *L. talazaccii* Ren. & Card.

Ferdinand Renauld published *Essai sur les Leucolomas* in 1909, the first and only comprehensive treatment of *Leucoloma*, enumerating 131 species for the world. Renauld & Cardot (1915) produced *Les Mousses de Madagascar*, which described 38 species of *Leucoloma* for Madagascar. Crosby et al. (1983) listed 51 species for Madagascar and nearby islands, based on available literature. From current revisionary work on the genus, collections from Montagne d'Ambre by Crosby in 1972 have resulted in the description of a distinct taxon, *Leucoloma crosbyi* LaFarge-England.

Leucoloma is a large pantropical genus that has a strong center of diversity in the rainforests of east Africa, Madagascar, and surrounding islands. Specific endemism for this region is 94 percent. The revision of the genus is expected to modify this figure, though rates of endemism should remain high for this region. The species described below supports this view.

Leucoloma crosbyi LaFarge-England, sp. nov. TYPE: Madagascar. Diego Suarez: Montagne d'Ambre, Parc National, 10 km along trail between Petit Lac and Grand Lac, 12°34′S, 49°12′E, 13 Nov. 1972, 1,200 m, *Crosby & Crosby 7167* (holotype, MO; isotype, ALTA). Figures 1–12.

Dioicous. Plantae robustae, pallide vel glauco-virides ad 5 cm altae. Folia longa et flexuosa. Cellulae juxtacostales papillosae densissimae obscurae in vittis utrinque ⅘ distalis costae latere dispositae. Latibasis scariosa sensim angustata versus marginem hyalinam. Cellulae alares planae, rufo-fuscae, scalariformes. Setae 1.0–2.0 mm longae. Capsulae 0.9–1.5 mm longae, ovales ad oblongae, erectae, immersae. Dentes peristomii quasi ad basim divisi. Calyptrae mitratae. Species haec ab *Leucoloma grandidieri* Ren. et Card. differt vix rugosis laminis et foliis longioribus, costa latiore et vittis cellularum juxtacostalium papillosarum versus basim angustioribus.

Dioicous. Plants robust, erect to spreading, pale to glaucous green or tan to light-brown, forming loose tufts up to 5 cm tall. *Stems* red, nontomentous, elliptic in transverse section (0.36–0.32 mm long by 0.31–0.24 mm wide), central strand lacking, outer 3–5 layers of red-brown, thick-walled cortical cells with smaller lumen than the homogenous inner, yellow to tan walled cortical cells; stems densely leaved, unbranched or sympodially branched, fertile branches distally ramulose from subapical innovations below perichaetia or perigonia, 1 to several. *Rhizoids* smooth, red-brown, several to numerous at the base of stem or potentially deciduous branches encircling supporting axis. *Juvenile* leaves 0.3–3.0 mm long, ovate to ovate-lanceolate, apices shortly acuminate to acuminate, at base of each branch and stem. *Leaves* erect to wide spreading wet or dry, 4.0–6.5 mm long, 0.2–1.2 mm wide, narrowly ovate-lanceolate to lanceolate, plane to slightly concave below, not to slightly transversely rugose in medial region, tapering gradually to a long, subulate, subtubulous, nonrugose acumen; apices flexuose to slightly incurved when dry. Mean acumina to shoulder, shoulder to base ratio is 1 : 1.65. *Margins* plane, entire, with a distinct, narrow, hyaline border ranging from 1 to 2 cells at the base of the leaf, reaching a maximum width of 3–6 cells (9.6–16.8 μm wide) in the median region of the leaf, narrowing to a single cell in the upper region and ending below the apex; apex rounded or acute, serrulate to multiserrate. *Costa* 52.8–106.0 μm wide at base, subpercurrent, ending 3–6 cells below the apex, shiny, translucent; transverse section plano-convex to elliptic, 24.0–33.6 μm diam., with abaxial and adaxial stereids in 3–5 rows, guide cells 4–6 in a single row, sometimes double. *Juxtacostal cells* 4.8–12.0 μm long, 4.8–7.2 μm wide, irregularly quadrate

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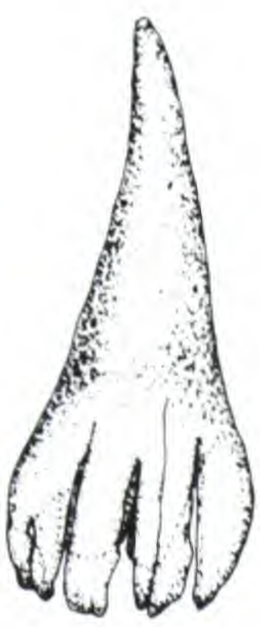

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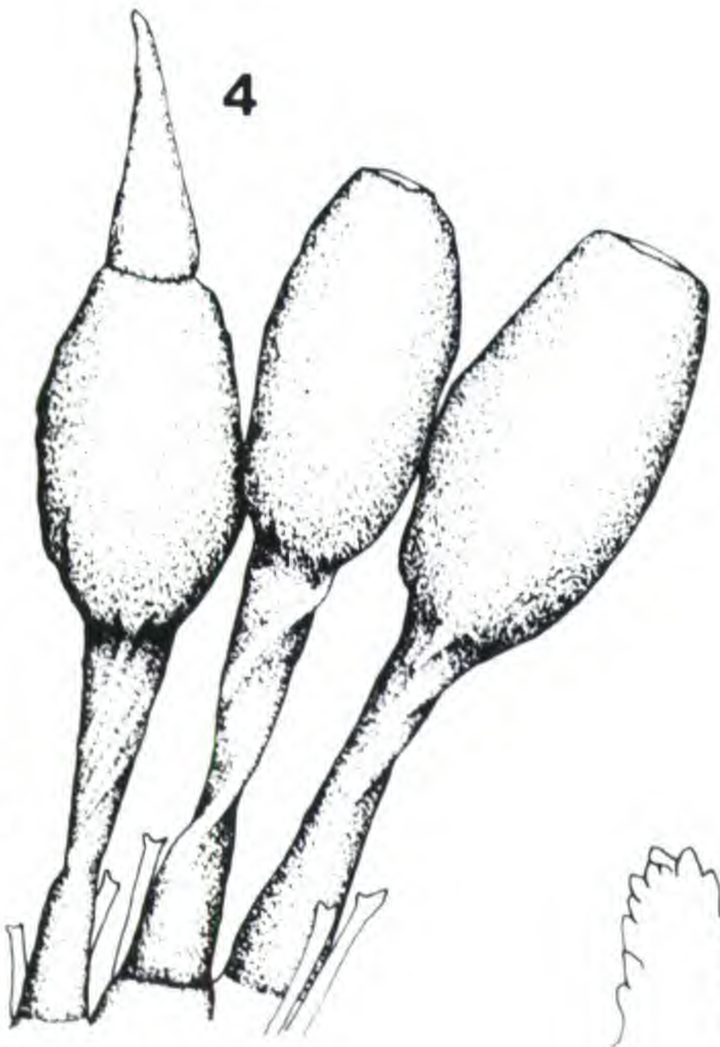

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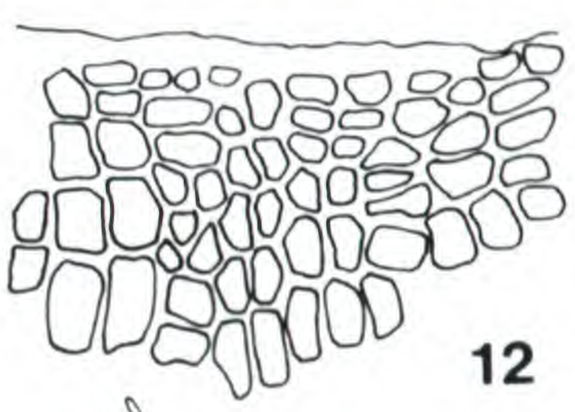

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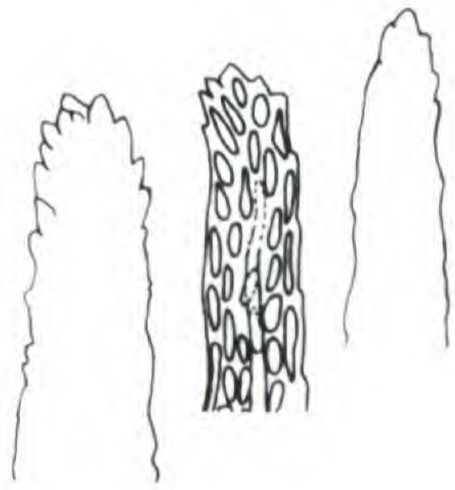

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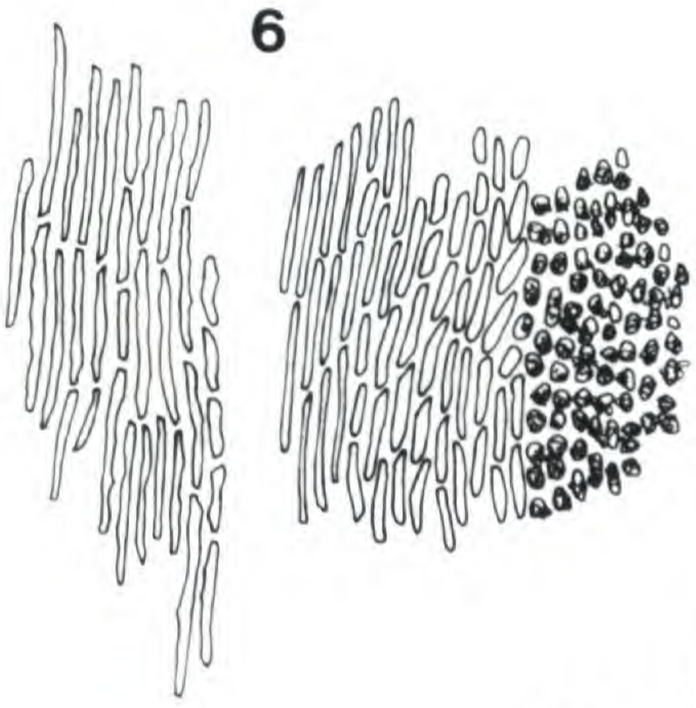

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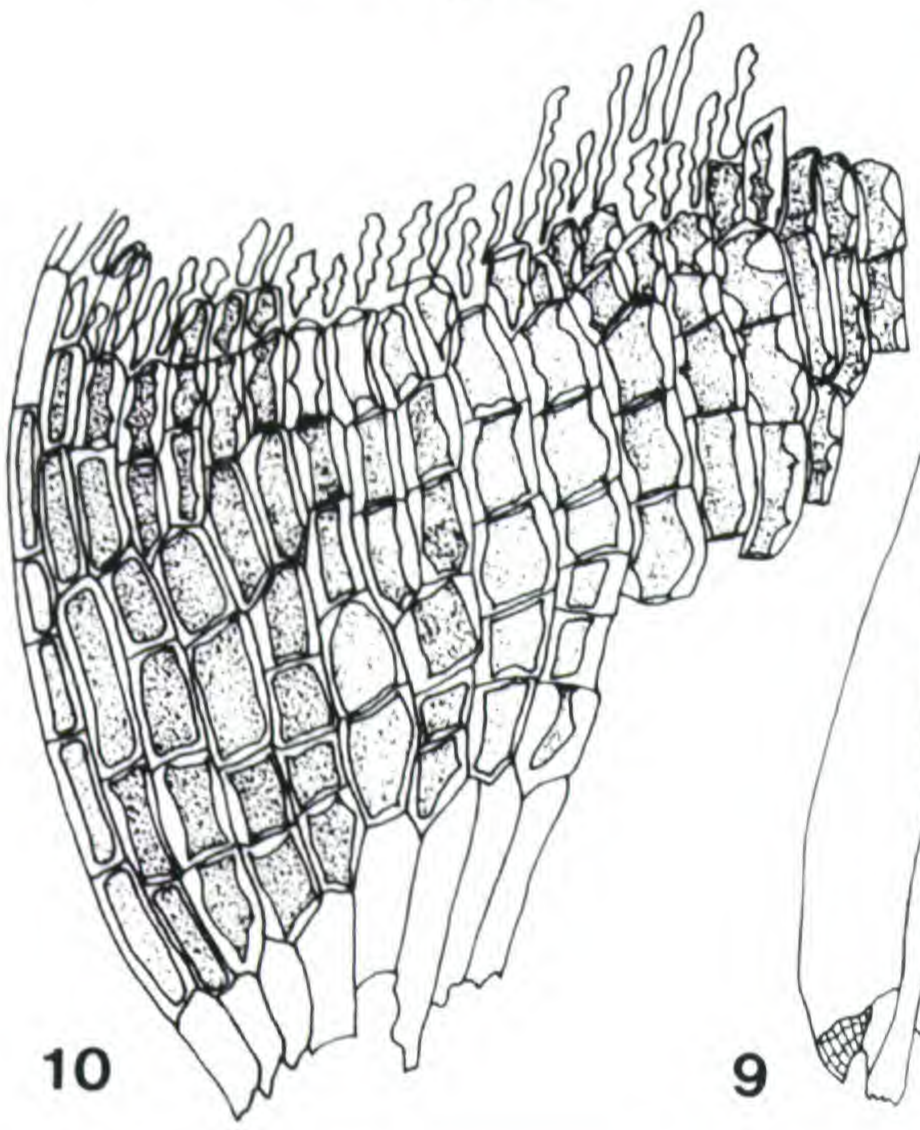

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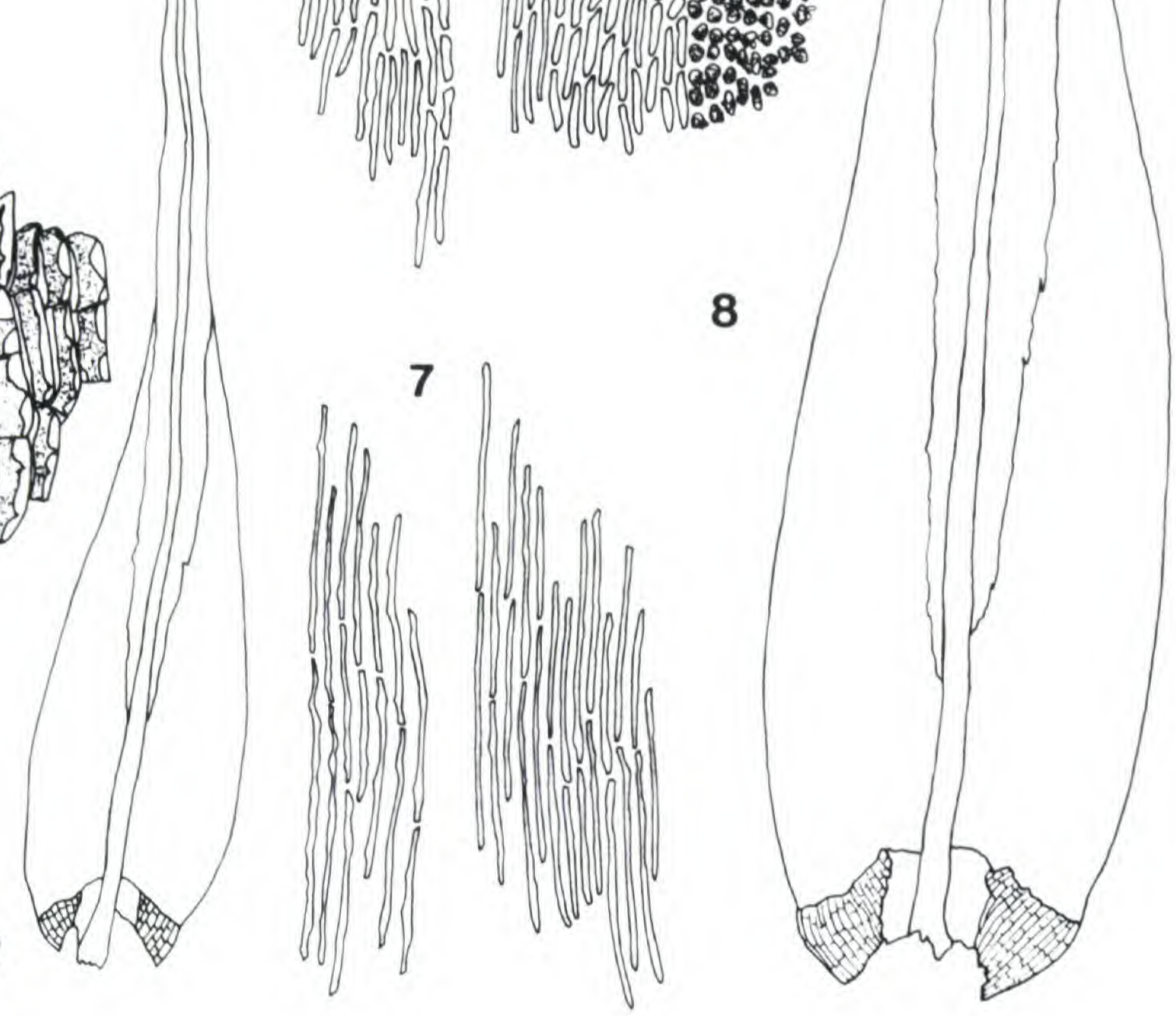

9

figs. 1,2: ——— 1mm

figs. 3,4,8,9: ——————— 1mm

figs. 5,6,7,10,11,12: ——— 0.01mm

Figures 1–12. *Leucoloma crosbyi* LaFarge-England. —1. Mature capsule, *Crosby & Crosby 7167* (ALTA). —2. Operculum with fringed calyptra, *7167* (MO). —3. Calyptrae, *7167* (MO). —4. Polysetous perichaetium, immature capsules, *7167* (MO). —5. Mature leaf apicies, *7167* (MO, ALTA). —6. Medial interior and juxtacostal cells, *7167*

rounded to oblong, pluripapillose, with low multifid papillae on abaxial and adaxial surfaces, filling acumen and extending as narrow, opaque bands on either side of the costa, gradually tapering as a narrow V-shaped wedge in the lower ⅓ of lamina, bi- to multistratose in 2–6(–9) rows on either side of the costa, becoming unistratose toward the interior cells, occasionally with isolated, irregular, narrow bistratose bands, sharply delimited from smooth interior cells. *Interior cells* smooth, hyaline to brownish, nonchlorophyllose, thick-walled, forming a shiny, scarious membrane, extending from the base to the base of the acumen; *medial to upper* 24–72(–106) μm long, 6–7 μm wide, elongate to linear, nonporose to porose; *basal* (24–)36–132 μm long, 7–11 μm wide, elongate to linear, strongly porose. *Marginal cells* 168–204 μm long, 2–3 μm wide, narrowly linear, hyaline, smooth. *Alar cells* quadrate to rectangular, 12–72 μm long, 12–34 μm wide, in 11–17 seriate columns, cell lumen conspicuously granulose, longitudinal walls thick, ± nodose, scalariform, red-brown (sometimes hyaline), flat, sharply differentiated into a triangular to trapezoidal region, separated from the costa by a band of strongly nodose, elongate, yellow-brown cells. *Perichaetia* terminal, sessile. *Perichaetial leaves* 2–6 mm long, 0.75–1.1 mm wide, broadly ovate-lanceolate, sharply contracted to long, narrow, acuminate, aristate, flexuose apex; base clasping convolute, alar cells not differentiated; *basal* cells 36–60 μm long, 7–12 μm wide, elongate, strongly porose, yellow-brown to orange-brown; *medial* cells elongate, elliptic, somewhat inflated (enlarged), orange-brown in basal region; *margins* subentire at base, plane; *costa* 72–48 μm wide at base, single, excurrent. *Archegonia* 0.8–1.4 mm long, with necks 0.7–1.3 mm long, red-brown, ca. 20–28 per perichaetium; with numerous hyaline *paraphyses* 0.7–0.9 mm long. *Perigonia* terminal, sessile with 1–4 short subapical branchlets, each producing a terminal perigonium. *Perigonial leaves* 0.9–1.6 mm long, ovate with abruptly narrowing, short, acuminate apices, convolute; *basal* cells 36–84 μm long, 7–12 μm wide, elongate, yellow to yellow-orange, extending up into ⅔ of leaf; *medial* cells 24–67 μm long, 7–24 μm wide; *antheridia* 0.70–0.95 mm long, 0.10–0.15 mm wide, red-brown to yellow-brown, with numerous hyaline paraphyses, 0.60–0.95 mm long. *Sporophyte* single or polysetous (to 4 per perichaetium observed), immersed. *Seta* stout, short, 1.0–2.0 mm long, slightly twisted toward the right, somewhat flexuose, orange-tan, smooth. *Capsules* oval to oblong 0.9–1.5 mm long, 0.5–0.6 mm wide, stomates lacking, light brown to tan, annulus not differentiated; exothecial cells 19–60 μm long, 9.6–36.0 μm wide, rectangular to quadrate, becoming oblate just below rim. *Operculum* conic with flanged base. *Peristome* teeth 16, asymmetrical, bifid almost to ⅔ of length, bases commonly reflexed, distally erect, filiform (some capsules have incurved peristome), inserted well below rim, red-brown, differentially thickened on inner surface; primary peristomal layer with external surface smooth at base, medial portion roughened to papillose, papillose to striate-papillose distally; inner peristomal layer with internal surface smooth at base, papillose to papillose striate distally. *Calyptra* mitrate, broadly fringed to lobate (7–20 lobes), hyaline, pale yellow to tan be-

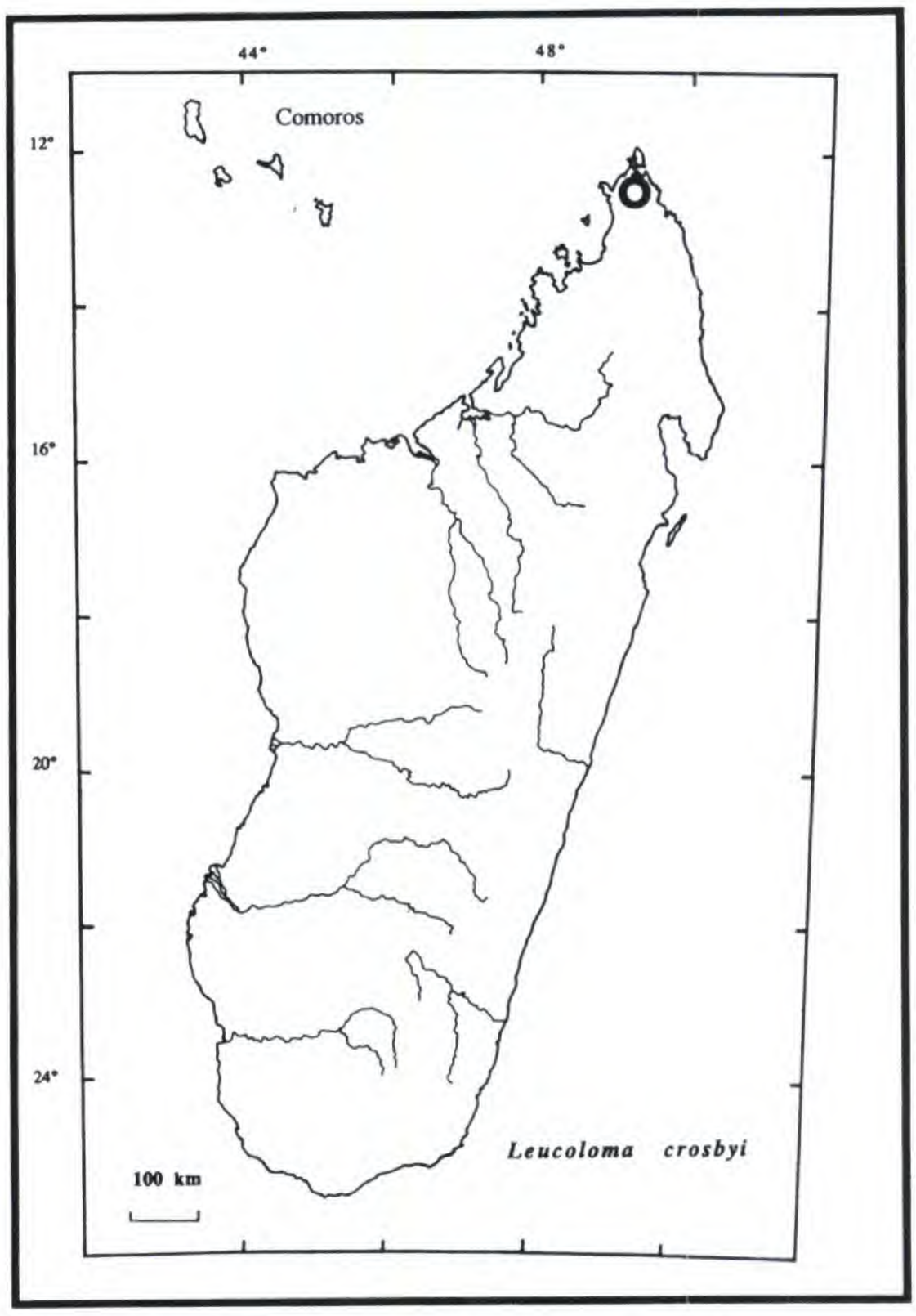

Figure 13. Distribution of *Leucoloma crosbyi*.

←

(MO, ALTA). —7. Basal interior cells, *Crosby & Crosby 7170* (MO). —8. Mature stem leaf, *7170* (MO). —9. Juvenile leaf, *Crosby & Crosby 7034* (L). —10. Alar cells, *7170* (MO). —11. Costal cross section, *7304* (L), *7167* (MO). —12. Exothecial cells just below mouth, *7167* (ALTA).

low, orange-brown above, smooth to slightly roughened above. *Spores* 24–31 μm, finely granulate.

Paratypes. MADAGASCAR. DIEGO SUAREZ: Montagne d'Ambre, Parc National, 10 km along trail between Petit Lac and Grand Lac, 12°34′S, 49°12′E, 13 Nov. 1972, 1,200 m, *Crosby & Crosby 7170* (MO); 0–5 km along trail between Petit Lac and Grand Lac, 12°34′S, 49°12′E, 12 Nov. 1972, 900–1,100 m, *Crosby & Crosby 7304* (L).

Habitat. Corticolous, ramicolous, 900–1,200 m above sea level.

Leucoloma crosbyi is distinguished by its robust habit, with erect to wide spreading leaves with transparent, shiny laminae sharply differentiated from a narrow band of opaque, densely papillose juxtacostal cells gradually tapering to costa in the basal region, which are not to hardly rugose, with long flexuose acumina. The leaves are bordered by a very narrow, hyaline margin and have abruptly differentiated alar cells, which are longitudinally thick-walled, red-brown, arranged in 11–17 columns, forming a triangular to trapezoidal region. *Leucoloma crosbyi* is distinguished from *L. grandidieri* Ren. & Card. by its longer, stiffer, nonrugose leaves; opaque juxtacostal bands extending farther into the basal region of the leaf and gradually narrowed; laminal transverse section showing a greater number of bi- or multistratose rows between the costal and unistratose laminal cells. *Leucoloma grandidieri* has 1–2(–3) rows, and *L. crosbyi* has (2–)3–6(–9).

The known distributions of these two species are allopatric, *L. crosbyi* endemic to Montagne d'Ambre at the northern tip of Madagascar and *L. grandidieri* confined to the eastern central region. *Leucoloma crosbyi* is distinguished from *L. talazaccii* by its more robust habit, lack of caducous lower stems, larger leaves, longer interior cells, and well-developed, granulose, scalariform alar cells.

The leaves of *Leucoloma crosbyi* vary from smooth to slightly rugose in the medial opaque region, with flexuose to slightly incurved acumina. The apices vary from acute to rounded and toothed. The number of rows of bi- to multistratose cells between the costa and the unistratose lamina varies from 2 to 9. Isolated bistratose strips have been observed within the opaque bands, as well as the more common bistratose to multistratose transition between the costa and unistratose lamina.

Distribution. Leucoloma crosbyi is known only from Montagne d'Ambre, Province de Diego Suarez, Madagascar (Fig. 13). The distribution is based on four specimens, which form the type material for the new species.

Etymology. The species has been named *L. crosbyi* after Marshall R. Crosby, the collector of all the known specimens. His contribution of recent material from the 1970s, as well as the critical compilation of the bryological literature, has helped to establish a foundation for future bryological research in Madagascar.

Acknowledgments. Special gratitude is expressed to Marshall R. Crosby for encouragement and support in the initial part of this project and for his rigorous collecting in the early 1970s, which has provided the essential data for this taxon. Further support and helpful discussions have been provided by Dale H. Vitt.

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——— & J. Cardot. 1915. Mousses de Madagascar. *In:* A. & G. Grandidier, Histoire Physique, Naturelle et Politique de Madagascar 39: 1–562.

Porotrichum cavifolium comb. nov. (Musci: Neckeraceae)

Robert E. Magill and Bruce Allen
Missouri Botanical Garden, P.O. Box 299, St. Louis, Missouri 63166, U.S.A.

ABSTRACT. Recent collections and new morphological information justify the transfer of *Pireella cavifolia* to *Porotrichum* and its treatment within Neckeraceae in the *Moss Flora of Mexico*.

New morphological evidence and a review of recent collections of *Pireella cavifolia* (Card. & Herz.) Card. have led to the following reevaluation of its relationships.

Pireella cavifolia is a small, dendroid moss known from the West Indies and Mexico south through Guatemala (San Marcos, *Croat 40961A*, MO) to Panama (Darién, *Allen 8917C*, MO) and Colombia (Risaralda, *Wolf 1435*, MO). The species has undifferentiated alar cells and clearly differs from other members of *Pireella* in having obovate leaves that are broader above and lack a distinct flattened apical portion. The sporophyte of *P. cavifolia* is unknown.

Allen (1987), in a broad survey of pseudoparaphyllia in the Pterobryaceae, found that the family is characterized by the presence of filamentous pseudoparaphyllia. In his survey, the only two species that lacked such structures were considered misplaced in the Pterobryaceae. *Pireella cavifolia* does not have filamentous pseudoparaphyllia; instead, it appears to have either folious pseudoparaphyllia or rudimentary branch leaves around its branch primordia. The absence of sporophytic evidence for *P. cavifolia* makes its placement problematical, but on the basis of its lack of filamentous pseudoparaphyllia we exclude the species from the Pterobryaceae.

The presence in this species of folious structures around the branch primordia, a dendroid habit, undifferentiated alar cells, and especially the occasional production of flagelliform gemmiferous branches all indicate the Neckeraceae as a likely placement for it. Within the Neckeraceae, *Porotrichum* could accommodate it. This transfer is therefore made so that the species can be treated within the Neckeraceae for the *Moss Flora of Mexico*.

Porotrichum cavifolium (Card. & Herz.) Magill & Allen, comb. nov. Basionym: *Pirea cavifolia* Card. & Herz. in Card., Rev. Bryol. 38: 39. 1911. *Pireella cavifolia* (Card. & Herz.) Card., Rev. Bryol. 40: 17. 1913. TYPE: Mexico. Hidalgo: Honey-station, *Pringle 15668* pro parte (holotype, PC). Illustrations: Thériot (1940, pl. 54, 5a–5f as *Jaegerinopsis ramosa*); Arzeni (1954, pls. 22–23).

Acknowledgment. We thank the anonymous reviewer of the manuscript for useful comments.

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Arzeni, C. B. 1954. The Pterobryaceae of the southern United States, Mexico, Central America and the West Indies. Amer. Midl. Naturalist 52: 1–67.

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Notes on the Solanaceae of China and Neighboring Areas

William G. D'Arcy
Missouri Botanical Garden, P.O. Box 299, St. Louis, Missouri 63166, U.S.A.

Zhang Zhi-yun
Institute of Botany, Academia Sinica, 141 Xizhimenwai Dajie, Beijing 100044, China

ABSTRACT. Nomenclatural changes are made for the *Flora of China*, affecting *Anisodus*, *Archiphysalis*, *Leucophysalis*, *Physaliastrum*, and *Scopolia*.

ANISODUS

The nomenclature relating to the Asian genus *Anisodus* and its type species differs in various floras and revisions. The generic name and its type species are clarified below, and another species is transferred from *Scopolia* to *Anisodus*.

Since *Anisodus* was described in 1824, the taxonomic validity of its separation from *Scopolia* Jacq. (1764) has been disputed. Some workers have simply placed species of *Anisodus* in *Scopolia* (Dunal, 1852); others have recognized *Anisodus* as a section or series in *Scopolia* (Wettstein, 1895; Weinert, 1972); and others have considered it a distinct genus (Pascher, 1909; Chen & Chen, 1977; Wu & Chen, 1978; Sandina & Tarasevich, 1982). It will be treated as a distinct genus in the *Flora of China* (Zhang et al., in press).

Scopolia and *Anisodus* are members of the solanaceous tribe Hyoscyameae, characterized by capsular fruits that are partly or completely covered by the persistent fruiting calyx and strongly curved embryos contained in compressed seeds. Both genera include herbaceous plants with subactinomorphic flowers and five stamens situated at the level of the corolla mouth. However, in addition to grossly different overall appearance, the groups differ in the conspicuous details shown in Table 1.

Sandina & Tarasevich (1982) studied the pollen of *Anisodus* (*Whitleya*) and *Scopolia* and found differences, particularly in the structure of the pores and the pattern of the exine, that they considered to be of generic significance. Differences in the pollen of *Scopolia* (*S. carniolica*) (Punt & Monna-Brands, 1980) and *Anisodus* (*A. carniolicoides* (as *S. carniolicoides*), *A. tanguticus* (as *A. mairei*), and *A. acutangulus* (Zhang & Lu, 1984)) are contrasted in Table 1.

Anisodus and *Scopolia* are widespread in the Old World; their geography was reviewed by Weinert (1972) and by Lu & Zhang (1986). When separated, the two genera have distinct geographical ranges. *Anisodus* occurs in the Himalayan region from western Nepal to Yunnan, China, and northward from Assam along the central Yangtze–Mekong–Salwin watersheds (Hengduan Mountains) of China to nearly 39°N latitude. The two species of *Scopolia* show a disjunction between Japan, *S. japonica* Maxim., and eastern Europe, *S. carniolica* Jacq.

Weinert (1972) referred to an unpublished dissertation by Semenowa (1955), which we have not seen, but names he attributed to her in his publication were not effectively published by her nor validly published by him.

NOMENCLATURE OF *ANISODUS* AND *A. LURIDUS*

Anisodus Link in Sprengel, Syst. Veg. 1: 699. 1825 [1823 fide Flora 9: 2, 495. 1826, late 1824 fide Stafleu & Cowan 5: 813]. *Scopolia* sect. *Anisodus* Dunal in DC., Prodr. 13(1): 555. 1852. TYPE: *A. luridus* Link ex Sprengel.

Whitleya Sweet, News of Lit. & Fashion 3: 108. 13 Aug. 1925; Brit. Flower Gard. 2: 125. 1 Oct. 1825 [dates fide Airy Shaw, J. Bot. 85: 192–193. 1937]. TYPE: *Whitleya stramonifolia* Sweet.

Anisodus was described by Link in Sprengel's edition of *Caroli Linnaei . . . Systema vegetabilium*, edition 16, which actually appeared before its title page date of 1825. The original publication, which included the description of *A. luridus*, cited as a synonym *Nicandra anomala* Link, which was not validly described until the following year by Link and Otto (see below). The material on which *Anisodus* was based was grown in Berlin from seed obtained from England that was noted as being from Nepal. About a year later, the genus was again described under the name *Whitleya* from different material that also had come into cultivation in Europe from seed obtained in Nepal.

The plant known as *Anisodus luridus* was described four different times with three different epithets in publications that bear the frontispiece date 1824 or 1825; confusion about its correct name persists. The following reviews the history of naming this plant and presents the correct name.

Anisodus luridus Link in Sprengel, Syst. Veg. 1: 699. 1825 [late 1824 fide Stafleu & Cowan 5: 813]. *Scopolia lurida* (Link) Dunal in DC., Prodr. 13(1): 555. 1852. TYPE: same as *Nicandra anomala*.

Physalis stramonifolia Wall. in Roxburgh, Fl. India. ed. Carey, 2: 242. 1824. [Mar.–Apr. 1824 fide Stafleu & Cowan 4: 957]. *Scopolina stramonifolia* (Wall.) Kuntze, Rev. Gen. Pl. 2: 452. 1891. *Scopolia stramonifolia* (Wall.) Shrestha, Bull. Dept. Med. Pl. Nepal 2: 81. 1969. *Scopolia stemonifolia* Chen Cheih & Chen Chung-lien, Acta Phytotax. Sin. 15(2): 61. 1977, orthographic variant. *Scopolia stramonifolia* (Wall.) N. P. Balakrishnan, Bull. Bot. Surv. India 22: 176. 1980 [1982] redundant combination. TYPE: cultivated, London, from seed obtained from Robert Henry Jenkinson, perhaps through Reginald Whitley, noted as being from Nepal, specimen not known. Nepal, herb. *Wallich 2632* not seen, IDC microfiche 7394: 295.

Nicandra anomala Link & Otto, Icon. pl. select. 77. t. 35. July–Dec. 1825 [fide Stafleu & Cowan 3: 68]. TYPE: cultivated, Berlin, from seed obtained from England, noted as being from Nepal, specimen not known (lectotype, Link & Otto plate 35; same as *Anisodus luridus*). *Scopolia anomala* (Link & Otto) Airy Shaw, J. Bot. 75: 195. 1937.

Whitleya stramonifolia Sweet, News of Lit. & Fashion 3: 108. 13 Aug. 1825; Brit. Flower Gard. 2: 125. 1825 [1 Oct. 1825 date fide Airy Shaw, J. Bot. 85: 192–193. 1937]. *Anisodus stramonifolius* (Sweet) G. Don in Louden, Hort. Brit. 61. 1830. Based on *Whitleya stramonifolia* Sweet. *Physalis stramonifera* Chen Cheih & Chen Chung-lien, Acta Phytotax. Sin. 15(2): 61. 1977. orthographic variant. *Anisodus stemonifolius* Wu Cheng-yih & Chen Cheih, Fl. Reipubl. Popularis Sin. 67(1): 23. 1978, orthographic variant.

Anisodus fischerianus Pascher, Repert. Spec. Nov. Regni Veg. 7: 226. 1909. *Anisodus luridus* var. *fischerianus* (Pascher) C. Y. Wu & C. Chen, Acta Phytotax. Sin. 15(2): 62. 1977. TYPE: cultivated in Leningrad, seed from Sikkim–Tibet, specimen not seen.

Scopolia mairei Léveillé, Bull. Geogr. Bot. 25: 37. 1915 [Année 24 (4° Série)], fide Lauener, Notes Roy. Bot. Gard. Edinburgh 37: 146. 1978. *Anisodus mairei* (Léveillé) C. Y. Wu & C. Chen, Acta Phytotax. Sin. 15(2): 64. 1977. TYPE: China. Yunnan (Yun-Nan): Ma-Kong, rocks, 2,800 m, *E. E. Maire s.n.* not seen.

The first description of a plant of *Anisodus* was of *Physalis stramonifolia* by Nathaniel Wallich in a compilation of his plant descriptions published by Carey early in 1824. The description of *Anisodus luridus* followed later in the year: late in the following year, the same species was described as *Whitleya stramonifolia* by Robert Sweet. One might suspect that Sweet's name was in some way based on that chosen by Wallich, but there is no evidence to substantiate this. Sweet noted that his plant was "nearest related" to Link's *Anisodus*, which was first cultivated in Berlin in 1821, but he did not mention Wallich's work: his description is in different terms and differs in some details from that of Wallich, for example, "peduncle short, densely villous" compared with Wallich's "peduncle . . . sparingly villous."

TABLE 1. Differences between *Scopolia* and *Anisodus*.

Scopolia	*Anisodus*
	Flower and fruits twice as large
Calyx and corolla conical with straight lobes and limb	Calyx and corolla broadly campanulate with recurved lobes and limb
Corolla conspicuously exserted, at least twice as long as the calyx	Corolla shorter relative to calyx, less than twice as long or only slightly exserted
Flowering calyx of five, equal, membranaceous lobes	Flowering calyx splitting irregularly into 1–5 unequal, fleshy or subcoriaceous lobes
Corollas reddish purple, drying blue-purple	Corollas brownish purple or yellow, usually drying yellow
Pollen grains elliptical in equatorial view, aperturate with scabrate exine and 3–4-colpate	Pollen grains consistently subspheroidal, nonaperturate with verrucate exine and indistinct stratification

Soon thereafter, George Don (1830) accepted Link's generic concept and transferred Sweet's name to *Anisodus*. Thus, the name *A. stramonifolius* is occupied by *A. stramonifolius* (Sweet) G. Don, preventing the transfer of the earlier *Physalis stramonifolius* Wall. into *Anisodus* and supplanting *A. luridus* Link.

We recognize *Anisodus* as a genus, but for those who place *Anisodus* in *Scopolia*, the correct name in *Scopolia* is *S. stramonifolia* (Wall.) Shrestha.

We saw no material of *Anisodus fischerianus* and place it in synonomy based on the original description, which notes a funnelform-campanulate flowering calyx. Wu & Chen (1978), in making the combination *A. luridus* var. *fischerianus*, noted

leaves with 1–3 pairs of irregular coarse teeth and purple eyes inside the base of the corolla tube, but apparently they did not see the type. Pascher suspected this species to be a hybrid of *A. luridus* and *A. tanguticus*. Its provenance from Xizang (Tibet), China, and Sikkim, India, is within the range of *A. lurida*. *Anisodus luridus* is recorded from Sikkim, Bhutan, Nepal, and in China from Sichuan, Xizang, and northwestern Yunnan, occurring from 3,000 to 4,450 m.

Anisodus carniolicoides (C. Y. Wu & C. Chen) D'Arcy & Zhang Zhi-yun, comb. nov. Basionym: *Scopolia carniolicoides* C. Y. Wu & C. Chen, Acta Phytotax. Sin. 15(2): 59. 1977. TYPE: China. Yunnan: Deqen Xian, Baima Mountain (Pei-ma-shan), *T. T. Yu 8773* (holotype, HY). Paratypes: *K. M. Fang 392*, *T. T. Yu 9451*, *11396*, *13692* (all A).

Scopolia carniolicoides C. Y. Wu & C. Chen var. *dentata* C. Y. Wu & C. Chen, syn. nov. Acta Phytotax. Sin. 15(2): 60. 1977. TYPE: China. Sichuan: Muli Xian, *T. T. Yu 6291* (holotype, HY not seen; isotype, A). Paratype: *T. T. Yu 7180* (A).

Following our review of material from the full geographical range of the tribe Hyoscyameae—Europe to Japan and the former U.S.S.R. to India—we conclude that *Scopolia carniolicoides* should be placed in *Anisodus* and not with the European and Japanese species that have been called *Scopolia*. Variety *dentata* is based on specimens with toothed leaves, but such leaves sometimes occur in other specimens that are otherwise not different from more typical plants. It should be noted that during the period when Wu and Chen described these taxa, difficulties beyond their control prevented consultation of collections from places outside of China.

LYCIANTHES

Lycianthes neesiana (Nees) D'Arcy & Zhang Zhi-yun, comb. nov. Basionym: *Solanum neesianum* Wall. ex Nees, Trans. Linn. Soc. London 17: 42. 1837. *Solanum subtruncatum* Wall. ex Dunal in DC., Prodr. 13(1): 180. 1852. *Lycianthes subtruncata* (Wall. ex Dunal) Bitter, Abh. Naturwiss. Vereine Bremen 25: 478. 1919 [1920]. TYPE: *Wallich*. Cat. supp. 2620, year 1828 [or later?].

Lycianthes neesiana was treated as *Solanum subtruncatum* in the handwritten catalog of specimens collected by Nathaniel Wallich that was prepared by Wallich and George Bentham, and as *Solanum neesianum* in the supplement to the catalog. The catalog and supplement are handwritten lists without descriptions, and they do not meet requirements for effective, much less valid, publication. Up to the present, this species has gone under the name *Solanum subtruncatum*, probably because this name was used first in the 1828 catalog; *Solanum neesianum* first appeared in the supplement, presumably a later publication. The names were not validly published until later, the first being *Solanum neesianum* by Nees in 1837, who attributed the name to Wallich. The name *Solanum subtruncatum* was not validated until 1852 by Dunal and is considered to be a synonym of *L. neesiana*.

This species has a calyx with an entire, truncate margin and 1–10 teeth arising below the apex, a feature placing it in *Lycianthes* rather than *Solanum*.

PHYSALIASTRUM

Solanaceae subtribe Physalidinae Miers includes about a dozen genera characterized by having accrescent calyces, longitudinally dehiscent anthers, and mostly rotate corollas. The subtribe is centered in northern Mexico (*Chamaesaracha*, *Jaltomata*, *Margaranthus*, *Physalis*, *Quincula*), but it is also represented in temperate Asia (*Physaliastrum*, *Physalis*) and elsewhere. Generic lines have been unclear, leading to diverse nomenclature. A series of Asian species that has been variously known in *Archiphysalis*, *Chamaesaracha*, *Leucophysalis*, *Physaliastrum*, and *Physalis* appear to belong to a single genus, which should be called *Physaliastrum*.

Physaliastrum was described by Makino (1914) with two Japanese species, *P. echinatum* (Yatabe) Makino and *P. savatieri* (Makino) Makino, which were transferred from the American genus, *Chamaesaracha*. In a revision of *Chamaesaracha*, Averett (1973) concurred in excluding these species from *Chamaesaracha*. Kuang & Lu (1965) revised *Physaliastrum*, recognizing seven species, all in Asia. Kuang (1966) described the genus *Archiphysalis*, basing it on one element from Japan and another from western China. These species had been known as *Physalis*, *Physaliastrum*, or *Chamaesaracha*. Averett (1977), extending his studies on *Chamaesaracha*, reviewed a series of the Chinese species hitherto placed in *Physaliastrum* and concluded that they and other enigmatic North American species are congeneric with *Leucophysalis;* he had transferred these species into *Leucophysalis* earlier (Averett, 1970, 1973). Following Averett's view, Grierson & Long (1978) described a new variety in *Leucophysalis* from Bhutan.

After studying a range of material for preparation of the Solanaceae treatment for the *Flora of China* and for a study of *Leucophysalis grandiflora* (D'Arcy et al., 1990; D'Arcy & Keating, in prep.), the type species of *Leucophysalis*, we are able to separate the Asian from the American groups at the generic level on the basis of aspects of their fruiting calyces. In some of the Asian species the walls of the fruiting calyx are elaborated by emergences that give the entire living fruit a bristly appearance. This is illustrated for *Physaliastrum japonicum* by Yasaka (1983: 80, figs. 4, 5) and by Yoshisuke (1985: 199). When dried, the emergences are sometimes difficult to see, resembling flattened, near-hyaline scales or giving the calyx wall a muricate or roughened appearance. In two other cases, which had been segregated in the genus *Archiphysalis*, the calyx modification is somewhat different. In one of these, *Physaliastrum sinense*, the ribs are greatly thickened. In the other, *Physaliastrum chamaesarachoides* (Makino) Makino, illustrated by Kuang & Lu (1978: 51, plate 14, fig. 7, as *Archiphysalis kwangsiensis* Kuang), the calyx ribs are thickened and bumpy, suggestive of incipient teeth. Such emergences or elaborations are lacking on American species of *Leucophysalis* and related groups, e.g., *Physalis*, *Chamaesaracha*.

The separation of *Physaliastrum* from *Physalis* rests largely on the elaboration of the calyx in *Physaliastrum*. Flowering material of most species of *Physaliastrum* appears to be scarce in herbaria and was not available for our study. However, the literature notes that in most species of *Physaliastrum* the corolla is lobed, while in most species of *Physalis*—all those from the Americas—the corolla is apically subentire. (Although Waterfall's (1958, 1967) revision of the North American species included some species with lobed corollas, these have since been removed to other genera.) *Physalis alkekengi*, perhaps the only species of *Physalis* native to the Old World, does have shallowly lobed corolla lobes, but it has no sign of calyx elaborations typical of *Physaliastrum*.

One of the main characters that was used to justify separation of *Archiphysalis* is the degree to which the berry fills the fruiting calyx. In the species that were left in *Physaliastrum*, the berry fills the fruiting calyx, which is appressed to the berry wall. In *Archiphysalis*, the fruiting calyx greatly exceeds the berry in diameter and length, and the berry is free within the bladdery calyx. In *Physalis*, the fruit is usually like that of *Archiphysalis*, but sometimes it is like that in *Physaliastrum*. For example, in *Physalis philadelphica*, which is widely marketed for food in North America and Mexico, within a single lot of fruits, some will have the berry filling the calyx and tightly appressed to it, and others will have a small berry that is free from the bladdery calyx. This variability seems to be related to degree of overall development of the fruit: larger berries tend to fill the calyx, while younger or "poorer" fruits tend to have loose calyces. Thus, the degree to which the berry fills the calyx varies within a single population or species, and because the species in *Physaliastrum* and *Archiphysalis* are closely related to *Physalis*, we do not think this is an appropriate character for generic separation of *Archiphysalis* from *Physaliastrum*.

In *Physaliastrum* (*Archiphysalis*) *chamaesarachoides*, there are no emergences on the fruiting calyx walls, but the greatly thickened calyx ribs have erect teeth, presenting a somewhat bristly appearance. In *Physaliastrum* (*Archiphysalis*) *sinense*, the calyx ribs are thickened, resembling those of *P. chamaesarachoides*, but there are no teeth. This species is more like *Physalis* than any of the others in *Physaliastrum*, but differs in the thickened calyx ribs, which we have not seen in any species of *Physalis* or in any species of Physalidinae from North America. We consider the Asian species to be distinct from the American species and to form the single genus *Physaliastrum* on the basis of the elaborations of the fruiting calyx.

The differences noted between the species from *Archiphysalis* and those previously part of *Physaliastrum* may warrant recognition of the group at the sectional level or perhaps as a subgenus.

Physaliastrum yunnanense subsp. **bhutanicum** (Grierson & Long) D'Arcy & Zhang Zhi-yun, comb. nov. Basionym: *Leucophysalis yunnanensis* subsp. *bhutanica* Grierson & Long, Notes Roy. Bot. Gard. Edinburgh 36: 141. 1978. TYPE: Bhutan: Rinchu-Kancham, 5,000 ft., *Cooper 3943* (holotype, E not seen; isotype, BM not seen).

Although no material of this taxon was seen, the description by Grierson and Long notes "the accrescent acutely muricate calyx," which is characteristic of the Asian *Physaliastrum* and not the American *Leucophysalis*.

Physaliastrum sinense (Hemsley) D'Arcy & Zhang Zhi-yun, comb. nov. Basionym: *Chamaesaracha sinensis* Hemsley, J. Linn. Soc., Bot. 26: 174. 1890. *Archiphysalis sinensis* (Hemsley) Kuang, Acta Phytotax. Sin. 11(1): 62, pl. 8, 9, figs. 1–6. 1966. *Physalis sinensis*

(Hemsley) Averett, Ann. Missouri Bot. Gard. 57: 380. 1970. TYPE: China. Hubei (Hupeh): Yichang (Ichang) Xian and immediate neighborhood, *Henry 2902* (holotype, K not seen).

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Two New Combinations in the Endemic Hawaiian Genus *Cyanea* (Campanulaceae: Lobelioideae)

Thomas G. Lammers
Department of Botany, Field Museum of Natural History,
Chicago, Illinois 60605-2496, U.S.A.

ABSTRACT. Examination of types for 74 names published in *Delissea* by the late Harold St. John showed that most represent previously described species that are currently treated as members of the related genus *Cyanea*. Two of the types, however, represent morphologically distinctive species, which are referable to *Cyanea* sect. *Hirtellae*. New combinations in *Cyanea* are proposed, the two species are described in greater detail, and a key to the species of the section is provided.

Cyanea Gaudich. (Campanulaceae: Lobelioideae) is a genus of trees and shrubs endemic to the Hawaiian Islands. St. John (1987a) merged the genus with its close relative *Delissea* Gaudich. and described 74 new taxa under the latter name (St. John, 1987b, 1988). Altogether, St. John recognized 166 species and 50 nonautonymic varieties and forms within his concept of *Delissea*. In the treatment of Campanulaceae (Lammers, 1990) for the *Manual of the Flowering Plants of Hawai'i*, I argued for the retention of the traditional circumscription of these two genera, recognizing 52 species plus nine nonautonymic subspecies in *Cyanea* and just nine species plus three nonautonymic subspecies in *Delissea*. Publishing deadlines did not permit me to examine types and account for all the new names proposed by St. John in *Delissea*. However, it was suggested that most would fall within my concept of *Cyanea* and prove to be referable to previously described species, particularly *C. coriacea* (A. Gray) Hillebrand, *C. fissa* (H. Mann) Hillebrand, and *C. sylvestris* A. Heller.

In May and June 1991, I visited BISH in order to examine the relevant types and determine the best disposition for each of these names. This examination confirmed the original suggestion that most of St. John's names should be treated as synonyms of various previously described species. Two of the types, however, did represent morphologically distinctive species that were new to science and referable to *Cyanea* as circumscribed in the *Manual*. These two species are here transferred to that genus and described more fully. The remaining names will be accounted for in detail in a forthcoming monograph of the genus (Lammers, in prep.).

Cyanea eleeleensis (H. St. John) Lammers, comb. nov. Basionym: *Delissea eleeleensis* H. St. John, Phytologia 63: 341. 1987. TYPE: Hawaiian Islands. Kaua'i: Wainiha Valley, on side of intermittent stream below Pali 'Ele'ele, shaded gulch in wet forest, 700 ft., 19 July 1977, *Christensen 261* (holotype, BISH; isotype, BISH). [The holotype consists of a standard herbarium sheet bearing two detached leaves plus a jar of liquid-preserved floral material.]

Shrub, 1.8 m tall; stem glabrous. Lamina oblanceolate, 38.5–40.5 cm long, 11.5 cm wide, glabrous; upper surface green; lower surface pale green; margin minutely denticulate; apex acute; base cuneate. Petiole 7.8–8.5 cm long, 4 mm diam., glabrous. Inflorescence 11–20-flowered, densely short-pubescent; peduncle deflexed, 8–9 cm long, 5–7 mm diam.; rachis 2.5–4 cm long; bracts linear or narrowly triangular, 3 mm long, 1 mm wide, the apex acute; pedicels 10–17 mm long, bibracteolate in the lower ⅓; bracteoles linear or narrowly triangular, 2 mm long. Hypanthium obovoid, deeply 10-sulcate, 10–11 mm long, 11–12 mm diam., densely short-pubescent. Calyx lobes triangular, 4–5 mm long, 3 mm wide; apex acute. Corolla bilabiate, 46–47 mm long, purple with lighter longitudinal stripes, short-pubescent; tube curved, 19 mm long, 7 mm diam., cleft dorsally for ⅔ its length; dorsal lobes linear, 32 mm long, 3 mm wide, spreading horizontally; ventral lip 19 mm long, cut to its middle into three linear lobes 3–4 mm wide (the middle one a little wider than the others) and acute at apex. Staminal column slightly exserted, glabrous; filaments 35 mm long; anther tube 9 mm long, 3 mm diam., the lower 2 anthers with tufts of white hairs at apex. Berry (immature) subglobose, 12 mm long, 14 mm diam., purple, deeply 10-sulcate, crowned by the persistent calyx lobes. Seeds unknown.

Known only from the type locality in Wainiha Valley, Kaua'i, where it was found growing in wet forest at an elevation of 213 m.

Cyanea kolekoleensis (H. St. John) Lammers, comb. nov. Basionym: *Delissea kolekoleensis* H. St. John, Phytologia 63: 344. 1987. TYPE: Hawaiian Islands. Kaua'i: Wahiawa Valley, left side of stream, 765 m, 23 Sep. 1979, *S. Perlman 498* (holotype, BISH; isotypes, BISH—2 sheets). [The holotype consists of a standard herbarium sheet plus a jar of liquid-preserved floral material.]

Shrub; stem unbranched, 1.5–1.9 m tall, glabrous. Lamina narrowly elliptic, 16.5–27.5 cm long, 2.7–5.7 cm wide; upper surface green, glabrous; lower surface greenish white, glabrous or the midrib minutely and sparsely pubescent; margin minutely serrulate; apex acuminate; base cuneate. Petiole terete, 3.5–9 cm long, 2 mm diam., glabrous. Inflorescence 4–8-flowered, glabrous; peduncle deflexed, 13.5–16 cm long, 2–4 mm diam.; rachis 3–6.5 cm long; pedicels sharply recurved, 18–27 mm long, reduced in length toward apex of rachis. Hypanthium obconic or obovoid, 6–13 mm long, 6–11 mm diam., densely short-pubescent. Calyx lobes triangular or deltoid, 1.5–3 mm long, 1.5–3.5 mm wide, the apex acute. Corolla bilabiate, white shading to purple on the lobes, 50–52 mm long, densely short-pubescent; tube curved, 30–39 mm long, 5.5–9 mm diam., cleft dorsally for ½ its length; dorsal lobes linear, 13–19 mm long, 1.5–3 mm wide, acute at apex; ventral lobes linear, 10–15 mm long, 1.5–3 mm wide, acute at apex. Staminal column exserted; filaments 3.7–4.9 cm long, purple, glabrous; anther tube dark purple, 9–11 mm long, 2.5–4 mm diam., the lower 2 anthers with tufts of white hairs at apex. Berries unknown.

Endemic to the Wahiawa drainage of southern Kaua'i, in wet *Metrosideros* forest at 650–765 m elevation.

Additional specimens examined. Hawaiian Islands. Kaua'i: Koloa District, Lihu'e-Koloa Forest Reserve, NW of Wahiawa Bog, along tributary of Wahiawa Stream, NW of stream and SE of Hulua, 7 Dec. 1988, *Flynn & Wood 3229* (F, PTBG); Wahiawa Mts., NE of Hulua, near Waimea-Koloa district boundary, 6 Sep. 1991, *Perlman et al. 12235* (F, PTBG).

Cyanea eleeleensis and *C. kolekoleensis* are both referred here to section *Hirtellae* Rock, a group of species endemic to Kaua'i (Rock, 1919). This section is characterized by shrubby habit; relatively slender, unarmed stems; entire or minutely toothed leaves; densely pubescent flowers; hypanthium 6–13 mm long; triangular calyx lobes 1–5 mm long; and corollas 25–52 mm long. Both are distinct from the five previously known members of the group. Their long deflexed peduncles are unique to the section, as is the deeply sulcate hypanthium of *C. eleeleensis*. They and the other members of this section may be distinguished by the following key.

Key to the species of *Cyanea* sect. *Hirtellae*

1a. Peduncle deflexed, 8–16 cm long, with an elongate rachis 2.5–6.5 cm long.
  2a. Lamina oblanceolate, 38.5–40.5 cm long, 11.5 cm wide; peduncle 8–9 cm long, 5–7 mm diam., 11–20-flowered, pubescent; hypanthium deeply 10-sulcate, 11–12 mm diam.; dorsal corolla lobes longer than the corolla tube ..... *C. eleeleensis* (H. St. John) Lammers
  2b. Lamina narrowly elliptic, 16.5–27.5 cm long, 2.7–5.7 cm wide; peduncle 13.5–16 cm long, 2–4 mm diam., 4–8-flowered, glabrous; hypanthium smooth, 6–11 mm diam.; dorsal corolla lobes shorter than the corolla tube ..... *C. kolekoleensis* (H. St. John) Lammers
1b. Peduncle horizontal or ascending, 0.7–6 cm long, the rachis condensed or obsolete, less than 2 cm long.
  3a. Lamina narrowly elliptic.
    4a. Lamina 28–40 cm long, the margin undulate; peduncle 43–60 mm long; berries yellow .... *C. undulata* C. Forbes
    4b. Lamina 12–28 cm long, the margin flat; peduncle 7–10 mm long; berries purple .... *C. recta* (Wawra) Hillebrand
  3b. Lamina obovate, oblanceolate, or oblong.
    5a. Lamina 32–80 cm long; petiole 0.5–4 cm long, stout, winged; latex yellow; berries broadly obovoid, 10–15 mm diam., red-orange ..... *C. fissa* (H. Mann) Hillebrand
    5b. Lamina 10–37 cm long; petiole 2.5–8 cm long, slender, terete; latex white; berries globose or obovoid, 6–10 mm diam., yellow or orange.
      6a. Lamina 2–6 cm wide; calyx lobes 0.5–1 mm wide; corolla 30–40 mm long, the tube 3–4 mm diam., suberect ..... *C. hirtella* (H. Mann) Hillebrand
      6b. Lamina 5–13 cm wide; calyx lobes 1–2 mm wide; corolla 40–48 mm long, the tube 4–5 mm diam., gently curved ..... *C. sylvestris* A. Heller

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Five New Species of Ferns from the American Tropics

Robbin C. Moran
Missouri Botanical Garden, P.O. Box 299, St. Louis, Missouri 63166-0299, U.S.A.

ABSTRACT. Five new species of ferns, *Blechnum anthracinum*, *B. werffii*, *Saccoloma squamosum*, *Polypodium pinnatissimum*, and *Tectaria pubens*, are described as a result of work on general fern identification at MO and for the pteridophyte volume of *Flora Mesoamericana*.

Blechnum anthracinum R. C. Moran, sp. nov. TYPE: Bolivia. La Paz: Provincia de Nor Yungas, Cotapata, roadside behind gas station, 16°15′S, 67°50′W, 3,225 m, 27 July 1989, *Fay & Fay 2446* (holotype, MO; isotypes, LPB not seen, UC, US). Figure 1.

Plantae epiphyticae. Rhizoma 5–12 mm latum, anthracinum, reptans, internodiis 5–15 mm longis, stolonifera, stolonibus ca. 1 mm longis, anthracinis, squamis rhizomatis 3–6 mm longis, 1–2 mm latis, lanceolatis, anthracinis, denticulatis. Folia sterilia et fertilia monomorphica, petiolis 20–70 cm longis, ad basim anthracinis, ad apicem stramineis vel brunneis, omnino dense squamulosis, squamis 0.5–1 mm longis, adpressis, ciliatis rubrobrunneis, caducis. Laminae 20–55 cm longae, 6–13 cm latae, anguste lanceolatae, 30–55-jugatae, omnino 1-pinnatae, pinnis 3–6.5 cm longis, 0.5–1 cm latis, falcatis, basi valde cordatis auriculis rhachidi superpositis, ad basim foliorum valde reflexis, supra sparse et infra modice squamulosis, squamis valde denticulatis vel dissectis. Rhachis dense squamulosa, squamis rubrobrunneis, denticulatis, denticulis apice interdum bifurcatis.

Plants epiphytic; rhizome 5–12 mm wide, black, shiny, creeping, with internodes 5–15 mm long, stoloniferous, the stolons ca. 1 mm wide, black, shiny; rhizome scales 3–6 × 1–2 mm, lanceolate, blackish, denticulate; sterile and fertile leaves monomorphous; petioles 20–70 cm long, blackish basally, stramineous to brown distally, densely scaly throughout, with the scales 0.5–1 mm long, appressed, ciliate, reddish brown, caducous; lamina 20–55 × 6–13 cm, narrowly lanceolate, 1-pinnate throughout; pinnae 3–6.5 × 0.5–1 cm, 30–55 pairs, falcate, with the base strongly cordate-auriculate, the auricles sometimes overlapping the rachis, the basal ones strongly reflexed, sparsely scaly above, moderately scaly below, with the scales strongly denticulate or highly dissected; rachis densely scaly, with the scales reddish brown, denticulate, the apex of the denticulae sometimes bifurcate.

Paratype. BOLIVIA. LA PAZ: Province of Nor Yungas, 1 km W of Chuspipata, elfin forest with *Clusia*, *Weinmannia*, and *Myrica*, 16°17′S, 67°49′W, 3,140 m, *Solomon 7259* (MO).

Blechnum anthracinum grows in cloud forests in Bolivia, from 3,140 to 3,225 m. No other species of *Blechnum* with monomorphic sterile and fertile leaves grows at such high elevations or is epiphytic. Several characteristics of this species readily distinguish it from other monomorphic *Blechnum* species. The rhizome and stolons are black and shiny (thus the specific epithet). In leaf cutting, the pinnae are short-stalked or sessile throughout the length of the lamina (rather than adnate and confluent distally). The basal pinnae are strongly reflexed. The pinnae are more numerous (30–55 pairs) compared to closely related species such as *B. occidentale* L. (12–25 pairs) or *B. glandulosum* Kaulf. (19–40 pairs). The scales on all parts of *B. anthracinum* are strongly denticulate, and those on the rachis and costae are so dense they obscure the surface. The strongly toothed scales suggest a relationship with *B. stipitellatum* (Sodiro) C. Chr., a species known from Venezuela, Ecuador, and Peru. That species, however, is terrestrial, has dimorphic sterile and fertile leaves, larger rhizome scales, dull brown rhizomes, and lacks stolons.

Blechnum werffii R. C. Moran, sp. nov. TYPE: Panama. Chiriquí: Distrito Bugaba, Cerro Punta, around STRI house, cloud forest, rich in epiphytes, 8°52′N, 82°33′E, 2,220 m, 27 Jan. 1985, *van der Werff & Herrera 6500* (holotype, MO). Figure 2.

Plantae terrestres. Rhizoma erectum nec subarborescens, nec stoloniferum, squamis 1–1.5 cm longis, 0.2–0.3 cm latis, ovatis vel lanceolatis, concoloribus, pallide flavobrunneis, integris. Folia sterilia et fertilia dimorpha. Folia sterilia 17–41 cm longa, petiolis 8–20 cm longis, omnino atropurpureis vel pallide brunneis et maculis obscurioribus conspersis. Laminae steriles 9–21 cm longae, 3–6 cm latae, 11–25-jugatae, utrinque glabrae, 1-pinnatae, versus apicem pinnatifidae et gradatim angustatae, gemmis carentibus; pinnis 1.5–3 cm longis, 0.6–1 cm latis, anguste involutis, coriaceis, serratis, sessilibus, basi cordatis, rhachidi superpositis; rhachis et costae steriles pallide brunneae (vel rhachis atropurpurea), non papillosae, glabrae vel sparsim squamosae, squamis ovatis, pallide aurantiaco brunneis, adpressis, integris; aerophora basi pinnarum praesentia, minus quam 1 mm longa, oblonga. Folia fertilia 25–57 cm longa, quam foliis sterilibus

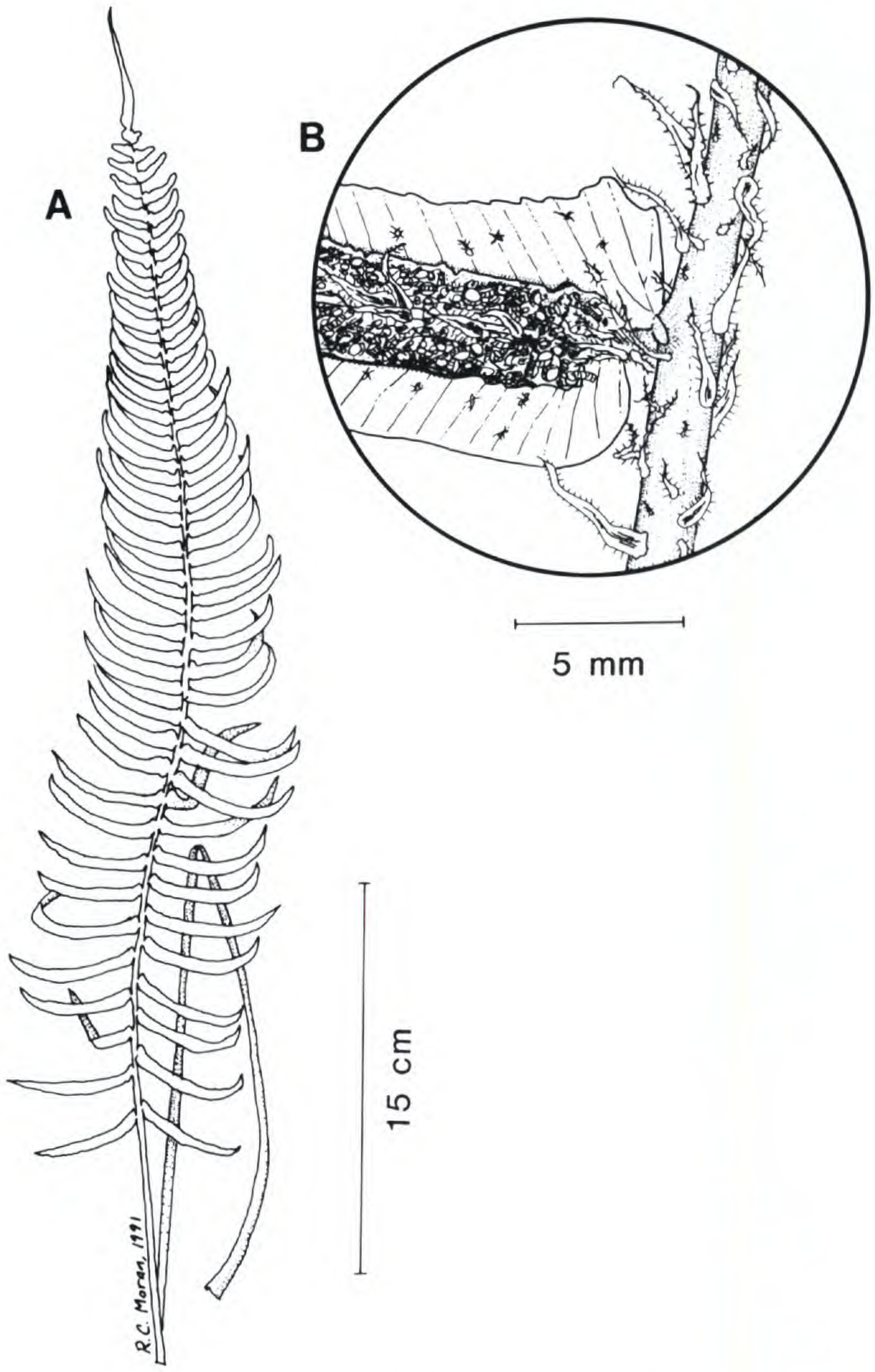

Figure 1. *Blechnum anthracinum* R. C. Moran. —A. Fertile leaf. —B. Rachis and pinna juncture. Note the slightly raised, circular aerophore on the rachis at the juncture. (*Solomon 7259*, MO.)

altiora, petiolis 17–35 cm longis, pallide brunneis et maculis obscurioribus conspersis, pinnis 1.2–2.5 cm longis, 0.2–0.3 cm latis.

Plants terrestrial; rhizomes erect but not subarborescent, not stoloniferous, the scales 1–1.5 × 0.2–0.3 cm, ovate to lanceolate, concolorous, light yellow-brown, entire; sterile and fertile leaves dimorphic; petioles 8–20 cm long, tan with brown spots or atropurpureous; lamina 9–21 × 3–6 cm, 1-pinnate, buds absent, the apex tapered, pinnatifid; pinnae 1.5–3 × 0.6–1 cm, pairs 11–25, narrowly involute, coriaceous, serrate, sessile, with the base cordate, overlapping the rachis; rachis and costae light tan or the rachis atropurpureous, not papillose, glabrous or sparsely scaly, the scales ovate, light orange-brown, appressed, entire; aerophores present at the pinna bases, less than 1 mm, oblong; laminar tissue glabrous on both surfaces; fertile leaves 25–57 cm long, erect, taller than the sterile leaves; petiole 17–35 cm long, tan with brown spots or atropurpureous; pinnae 1.2–2.5 × 0.2–0.3 cm.

Paratypes. COSTA RICA. HEREDIA: on the road N of San Rafael, ca. 6 mi. above Monte de la Cruz, cloud forest, 2,000 m, *Moran 2269* (MO). PANAMA. CHIRIQUÍ: Guadalupe, Cerro Punta, Finca Alfaro, 2,000 m, *Caballero 141* (MO, PMA).

Blechnum werffii is endemic to Costa Rica and Panama, where it grows in cloud forests from 2,000 to 2,200 m. The pinnae are distinctive by being short, obtuse, coriaceous, and glabrous on both sur-

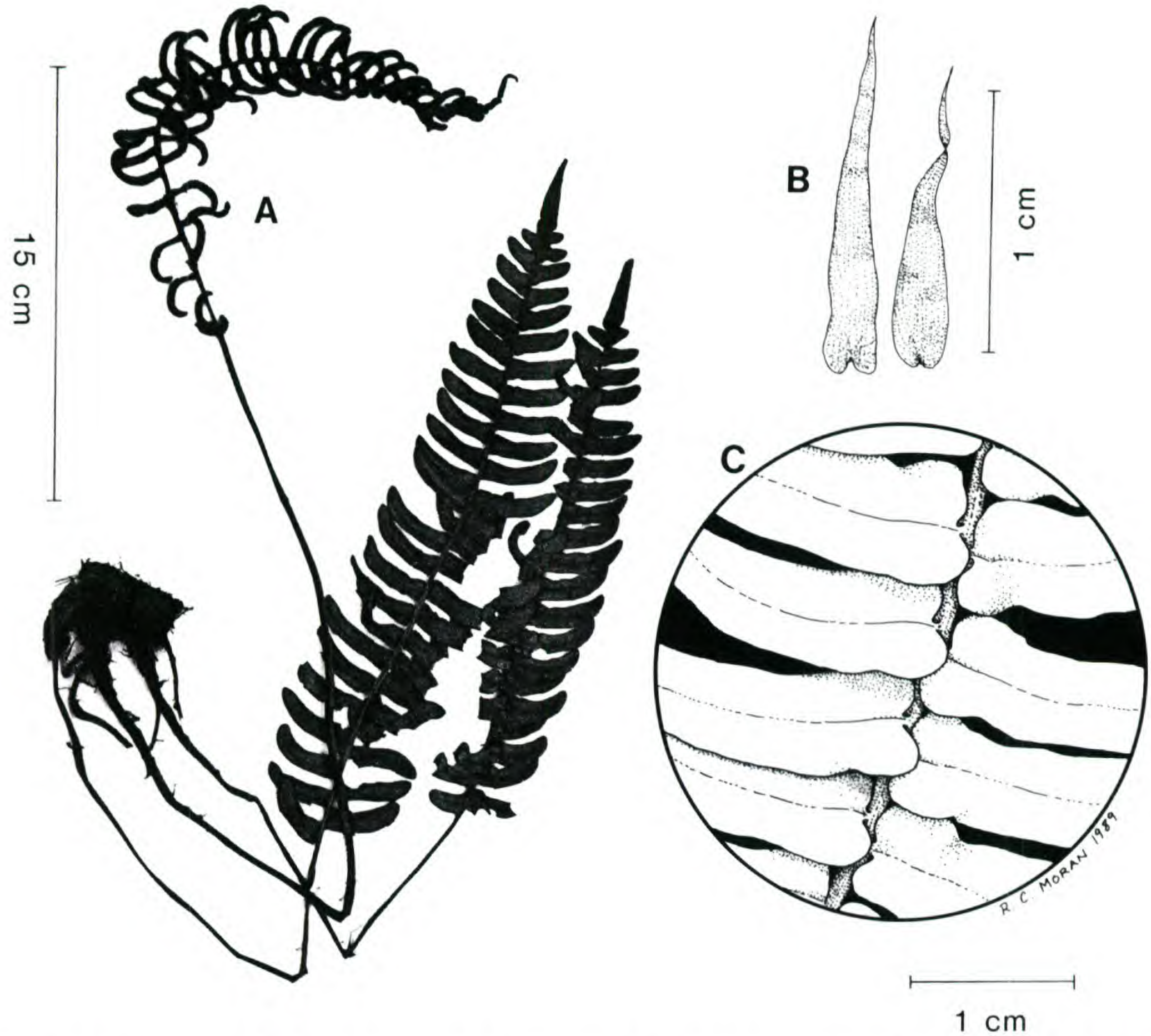

Figure 2. *Blechnum werffii* R. C. Moran. —A. Entire plant. Note the long petiole of the fertile leaf. —B. Petiole scales. —C. Pinna bases overlapping the rachis. (*van der Werff & Herrera 6500*, MO.)

faces. The petioles of the fertile leaves are extremely long relative to other species in the genus, being about twice the length of the fertile lamina (Fig. 2A). I cannot suggest another species of *Blechnum* that is closely related to *B. werffii*.

Saccoloma squamosum R. C. Moran, sp. nov.

TYPE: Ecuador. Zamora–Chinchipe: Nangaritza Cantón, Valle del Río Nangaritza, Miazi, bosque sobre pendientes fuertes de roca caliza o de pizarra, 78°40′W, 04°18′S, 1,200 m, *Palacios 6721* (holotype, MO; isotypes, F, NY, QCNE, UC, US). Figure 3.

Plantae rheophyticae. Rhizoma erectum, squamis 0.5–1 mm latis, 0.3–0.6 mm longis, linearibus, lucidis, castaneis, denticulatis. Laminae 2-pinnato-pinnatisectae, abaxialiter dense squamosae. Sporae flavidae.

Plants rheophytic; rhizome erect; scales 0.5–1 × 0.3–0.6 mm, linear, shiny, castaneous, denticulate; petiole ca. as long as the lamina, brown, densely scaly basally, lacking epipetiolar buds; lamina 15–45 × 6–15 cm, lanceolate; pinna pairs 10–18, alternate, stalked, the stalks 0.5–1 cm long; pinnules 1.5–4 cm long, anadromically arranged throughout, slightly falcate and ascending, stalked, the stalks 1–3 mm long; rachis, costules, and veins strongly scaly abaxially, much less so adaxially, the scales 0.5–2 mm long, spreading, often tortuous, brownish, lucid, denticulate; sori ending 0.3–0.5 mm before the margin, embossed on the adaxial surface of the leaf; spores yellowish.

Paratype. ECUADOR. ZAMORA–CHINCHIPE: Nangaritza Cantón, Valle del Río Nangaritza, Miazi, bosque sobre pendientes fuertes de roca caliza o de pizarra, 78°40′W, 04°18′S, 1,200 m, *Palacios 6737* (AAU, F, MO, QCNE).

Saccoloma squamosum most resembles *S. inaequale* (Kunze) Mett., which probably represents a complex of several species. *Saccoloma squamosum* differs from all its congeners by its densely scaly leaves, smaller leaf length, and linear, dentic-

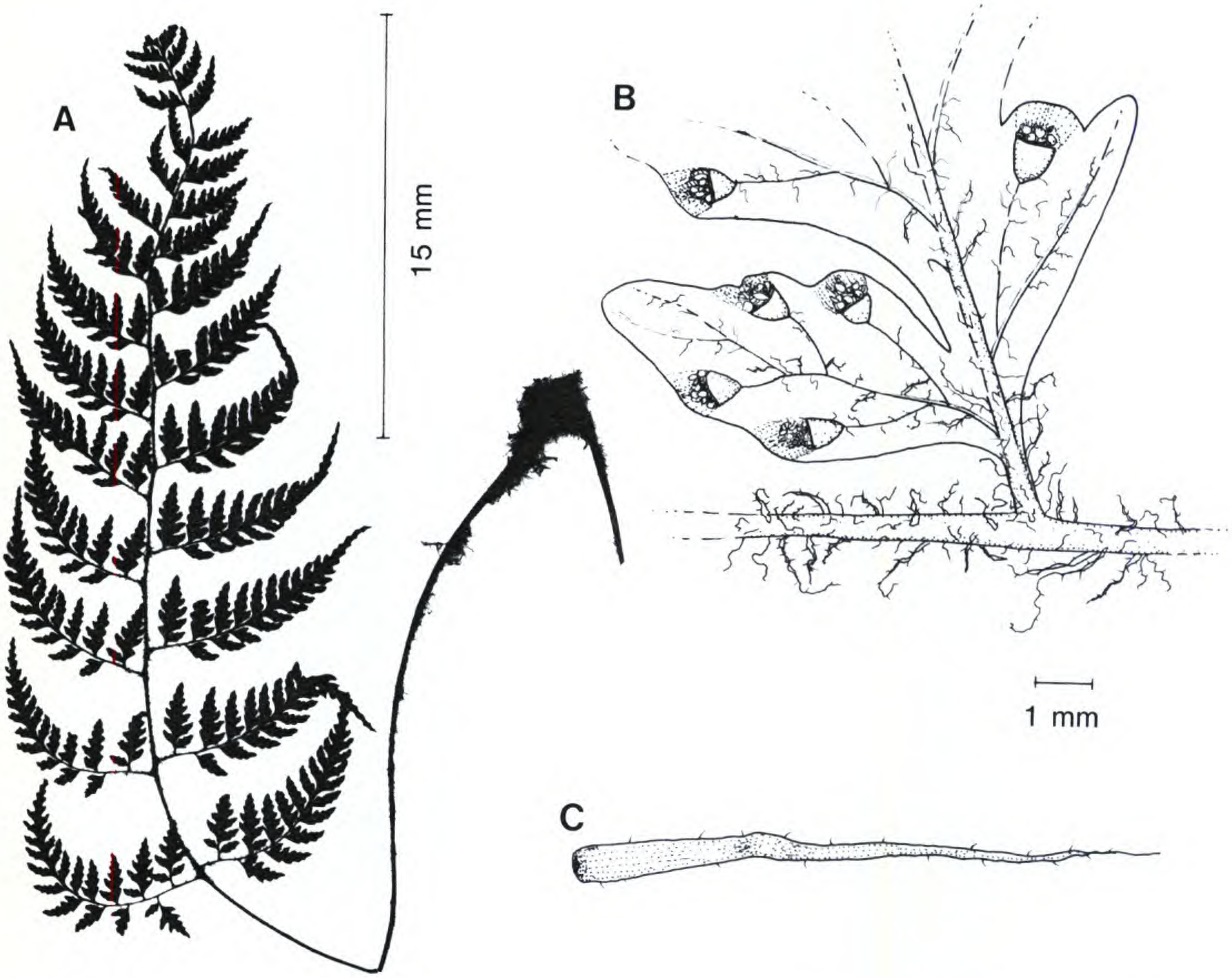

Figure 3. *Saccoloma squamosum* R. C. Moran. —A. Fertile leaf. —B. Pinnule base showing the strongly scaly axes and veins. —C. Rhizome scale. (*Palacios 6721*, UC.)

ulate, castaneous rhizome scales. Whereas all other neotropical species of *Saccoloma* are terrestrial, *S. squamosum* is a rheophyte. The valley where the specimens were collected is unusual geologically because of its vast limestone and slate outcrops. It may eventually be shown that *S. squamosum* is restricted to these rock types.

Saccoloma was reviewed by Tryon (1962), who recognized three species in the American tropics (i.e., *S. domingense* (Sprengel) C. Chr., *S. elegans* Kaulf., *S. inaequale* (Kunze) Mett.). Since then, the number of taxa has doubled from the addition of *S. membranaceum* Mickel, *S. elegans* subsp. *chartaceum* Nair ex Cremers & Kramer, and *S. squamosum*.

Polypodium pinnatissimum R. C. Moran, sp. nov. TYPE: Panama. Panamá–San Blas border: along El Llano–Cartí road, ridge trail along the divide, wet forest, 09°20′N, 78°58′W, 250–300 m, *Moran 4098* (holotype, MO; isotype, UC). Figure 4.

Plantae epiphyticae. Rhizoma 5–8 mm latum, repens, squamis 2–5 mm longis, 1–1.5 mm latis, ovatis, concoloribus, brunneis, non clathratis, integris, adpressis, pubescentibus. Laminae (15–)25–40 cm longae, (6–)20–30 cm latae, 1-pinnatae, apice conforme vel hastato, pinnis (3–)10–15 cm longis, 0.8–1.9 cm latis, integris, 8–16 utroque rhachidis latere; rhachis adaxialiter pubescens; venae liberae; sporangia setulosa.

Plants epiphytic; rhizome 5–8 mm wide, not prunose, creeping, the scales 2–5 × 1–1.5 mm, ovate, brown, concolorous, not clathrate, entire, appressed, usually comose basally with brown hairs at the point of attachment; petiole ca. ½ the length of the lamina, brown, sparsely puberulent abaxially, exalate; laminae (15–)25–40 × (6–)20–30 cm, deltate, 1-pinnate throughout, not reduced basally, abruptly reduced distally to a hastate or subconform terminal segment; pinnae (3–)10–15 × 0.8–1.9 cm, entire, pairs 8–16, opposite or subopposite and sessile in the basal part of the lamina, becoming adnate and alternate distally; rachis brown, pubescent adaxially, the hairs 0.2–0.3 mm long, 2–4-celled, antrorse;

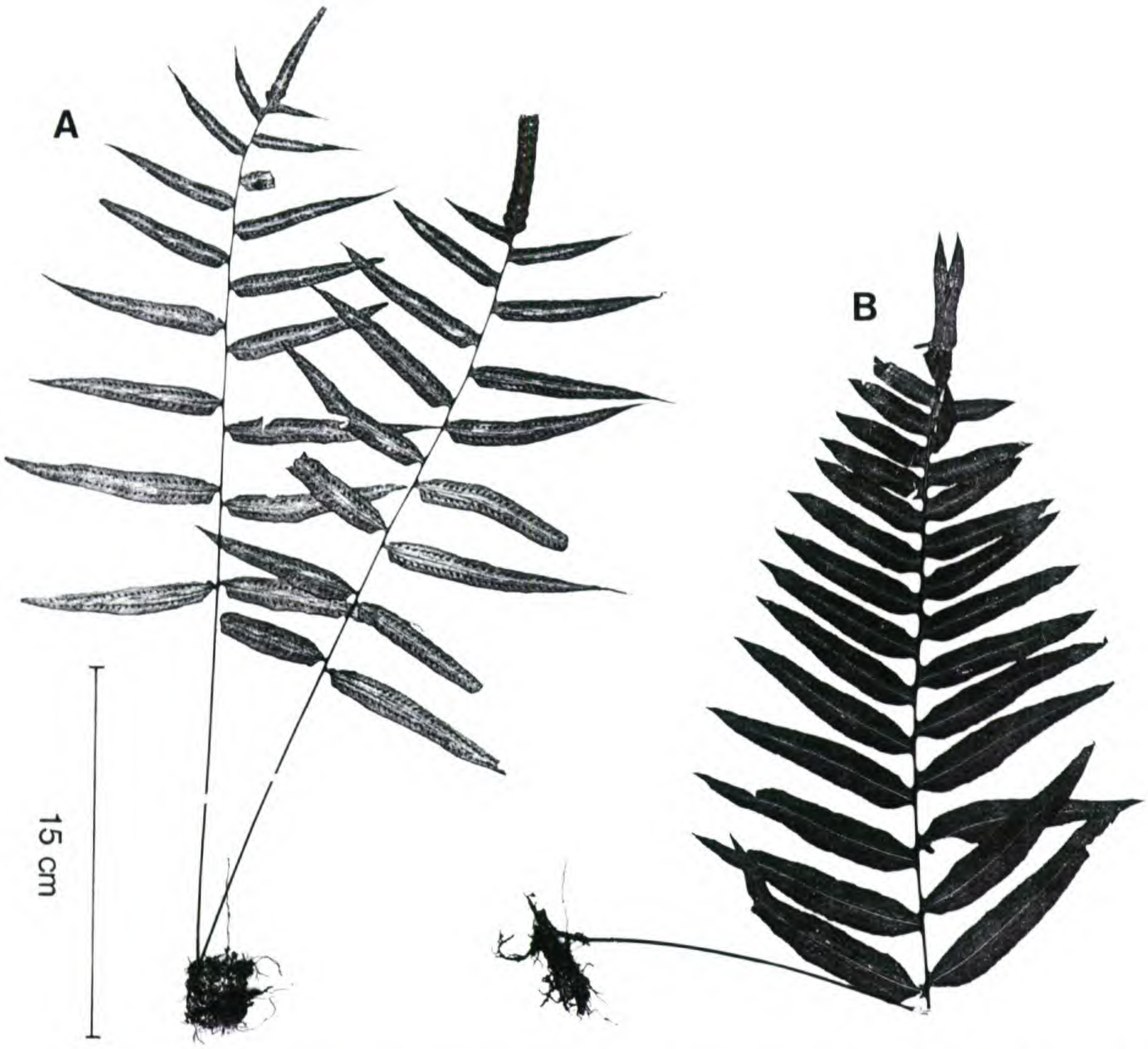

Figure 4. —A. Fertile leaf of *Polypodium pinnatissimum* R. C. Moran (*van der Werff 7027*, MO). —B. Fertile leaf of *P. dulce* Poiret in Lam. (*Moran 3198*, MO).

costae mostly whitish or brown basally, sparsely pubescent abaxially, the hairs ca. 0.1 mm long, occasionally branched, very pale reddish or brownish, moderately pubescent adaxially, the hairs ca. 0.2 mm long, antrorse, 2–4-celled; veins free; laminar tissue between the veins glabrous on both surfaces; sori round to elliptic, in one row between the costa and margin; sporangia setulose, the setulae ca. 0.1 mm.

Paratypes. COSTA RICA. ALAJUELA: Finca Los Ensayos, ca. 11 mi. NW of Zarcero, 900 m, *Croat 43509* (MO, UC), *43512* (MO). SAN JOSÉ: Reserva Biológica Carara, W part of Montañas Jamaica, ca. 3.5 km NE of Bijagual de Turrubares, 9°45.5′N, 84°33.5′W, 500–600 m, *Grayum 8582* (MO); Zona Protectora La Cangreja, along Quebrada Grande and on adjacent ridges, ca. 2 km NNE of Mastatal de Puriscal, 9°42′N, 84°22′W, 400–540 m, *Grayum 8636* (MO, UC). PANAMA. COCLÉ: along road between Llano Grande and Coclesito (N of Pintada), 4 mi. N of Llano Grande, 600 m, *Antonio 3577* (MO); La Mesa, above El Valle, 800 m, *Croat 25340* (MO); road from La Pintada to Coclesito, 80°30′W, 8°45′N, 600 m, *Hamilton & Davidse 2845* (MO, UC); S of Cascajal along Continental Divide, 8°45′N, 80°25′W, 800–900 m, *Knapp 1989* (CR, MO, UC), *1991* (MO); ca. 3 km NE of El Valle, *Mori & Kallunki 2973* (MO); foot of Cerro Pilón, above El Valle de Antón, ca. 600 m, *Porter et al. 4616* (MO); W slope and summit of Cerro Valle Chiquito, 700–800 m, *Seibert 510* (MO). COLÓN: Santa Rita Ridge, end of road from Transisthmian Hwy., ca. 10 mi. from hwy., *Porter et al. 4829* (MO). HERRERA: 18 km W of Las Minas, trail to top of Alto Higo, 800 m, *Hammel 4220* (CR, MO). PANAMÁ: Cerro Campana, near summit, 1,000 m, *Croat 22805* (MO), *12149* (MO), *Kennedy et al. 2055* (MO), *Porter et al. 4880* (MO), *Sytsma 3528* (MO), *van der Werff & Herrera 6204* (MO, UC). PANAMÁ/SAN BLAS: Nusagandi, *van der Werff 7027* (MO, UC). SAN BLAS: road from El Llano to Cartí, Pacific side, 79°00′W, 9°20′N, 200–300 m, *Hamilton & Stockwell 2936* (MO, UC); Campamento Nusagandi, sendero Ina Igar en el Llano–Cartí, 19 km de la Vía Interamericana, 350–400 m, *Herrera & Irvine 352* (MO, UC, US). VERAGUAS: 5 mi. W of Santa Fé on road past Escuela Agrícola, Alto Piedra, on Pacific side of divide, 800–1,200 m, *Croat 23058* (MO).

Polypodium pinnatissimum is closely related to *P. dulce* Poiret in Lam. (a species that has previously been called *P. sororium* Humb., Bonpl. & Willd.;

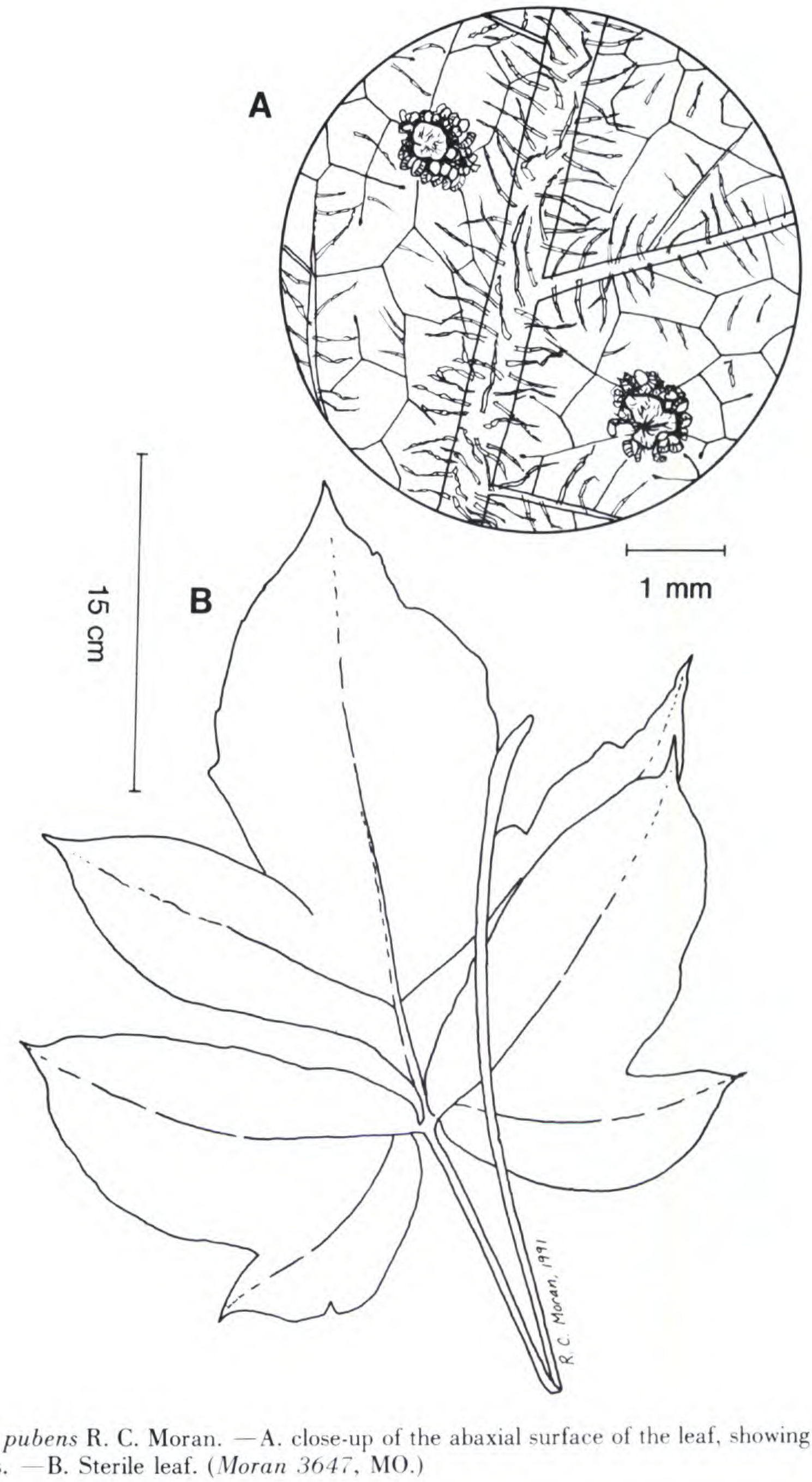

Figure 5. *Tectaria pubens* R. C. Moran. —A. close-up of the abaxial surface of the leaf, showing dense pubescence of long, septate hairs. —B. Sterile leaf. (*Moran 3647*, MO.)

Proctor & Lourteig, 1990). Both have free veins, similarly cut laminae, and round to elliptic sori. *Polypodium pinnatissimum* differs by its completely 1-pinnate lamina (Fig. 4A) and setulose sporangia. In contrast, *P. dulce* has mostly pinnatisect laminae (or 1-pinnate basally; Fig. 4B) and glabrous sporangia. Three other differences occur between the species, but these are not constant: *P. pinnatissimum* tends to have less visible veins, narrower (0.8–1.9 cm wide) pinnae, and hastate or subconform apices. In contrast, *P. dulce* often has darkened and easily visible veins (especially adaxially), wider (0.9–2.5 cm wide) pinnae, and more or less evenly tapered, pinnatifid apices. The two species also differ in range: *P. pinnatissimum* occurs in Costa Rica and Panama, whereas *P. dulce* occurs from southern Mexico to western Panama (Chiriquí), Venezuela, Colombia, Ecuador, and Peru. Most of the specimens of *P. pinnatissimum* are from Panama, where *P. dulce* is rare.

Tectaria pubens R. C. Moran, sp. nov. TYPE: Peru. Loreto: Prov. Maynas, ca. 50 mi. downriver from Iquitos, at Peter Jensen's Explorama Lodge, virgin forest, clay soils, ca. 120 m, *Moran 3647* (holotype, MO; isotype, UC). Figure 5.

Plantae terrestres. Rhizoma erectum vel decumbens, squamis 5–10 mm longis, lanceolatis, brunneis, integris. Petioli 40–60 cm longi, pubentes. Laminae 35–50 cm longae, late ovatae, 1-pinnatae, gemmis carentes, pubentes, pilis 0.4–1 mm longis, 5–8-cellularibus rufis praeditae; pinnae basales 10–16 cm latae, falcatae, acuminatae, ad basim basiscopice lobatae. Indusia reniformia vel circularia, pubescentia.

Plants terrestrial; rhizome erect or decumbent, the scales 5–10 mm long, lanceolate, dull brown, entire; lamina 35–50 cm long, broadly ovate, 1-pinnate, lacking buds; basal pinnae 10–16 cm wide, free with a short stalk up to 3 mm long, falcate, acuminate, entire except for a single basal basiscopic lobe; medial segment 20–30 × 8–12 cm, opposite, falcate, entire, acuminate, decurrent; terminal segment ovate, with one or two shallow lobes; rachis and costae abaxially densely pubescent (the surface often obscured); costules and veins pubescent abaxially, the hairs 0.4–1 mm long, 5–8-celled, pale reddish with most of the color aggregated in the septae, the cells often flattened, adaxially glabrous to sparsely pubescent; laminar tissue between the veins pubescent abaxially, glabrous adaxially; sori in 2(–4) rows between the main veins; indusia reniform to circular, persistent, brown, concolorous, pubescent on the surface and margins, the hairs ca. 0.1 mm long.

Paratypes. ECUADOR. NAPO: Jatun Sacha Biological Station, 8 km E of Misahuallí, 1°04′S, 77°36′W, 400 m, *Fay & Fay 2714* (F, MO, QCNE). PASTAZA: Vía Auca, 115 km al S de Coca, 10 km al S de la frontera Napo–Pastaza, cerca del Río Tiguino, carretera de PETROCANADA en construcción, bosque húmedo tropical, lomas del suelo rojo, 01°15′S, 76°55′W, 320 m, *Hurtado & Neill 1486* (MO). PERU. LORETO: Prov. Maynas, Yanamono Explorama Tourist Camp, halfway between Indiana and mouth of the Río Napo, nonflooded forest on rather fertile soil, 130 m, *van der Werff et al. 9886* (MO), *Gentry 29142* (MO, UC).

Tectaria pubens most closely resembles *T. pilosa* because of its pubescent laminae and similar leaf cutting. However, *T. pubens* has pinnae 10–16 cm wide, long-decurrent apical segments, and one pair of free basal pinnae. In contrast, *T. pilosa* has pinnae 2–5 cm wide, cuneate or short-decurrent apical segments, and 1–4 pairs of free pinnae.

Tectaria pilosa (Fée) R. C. Moran, comb. nov. Basionym: *Cardiochlaena pilosa* Fée, Mém. Foug. 10: 45, t. 40, f. 4. 1866. TYPE: Brazil. Rio de Janeiro: *Weddell 656* (P? not seen).

This species has been previously identified in herbaria as *Tectaria incisa* Cav. var. *pilosa* (Fée) C. Morton. It is here recognized at the specific level because the plants are morphologically distinct and do not intergrade with related species. In Costa Rica and Panama, *T. pilosa* grows commonly in lowland forests with *T. incisa* Cav. and *T. vivipara* Jermy & T. Walker. I have not seen intermediates that might be interpreted as hybrids between these species. From a distance, *T. pilosa* can be distinguished from the other two by its smaller leaves, lighter green laminae, and fewer (1–4) pairs of pinnae. The other species have leaves about twice as long, darker green laminae, and more numerous (4–12) pairs of pinnae. Closer examination of *T. pilosa* reveals that both surfaces of the lamina are pilose with spreading, septate hairs 0.2–0.8 mm long. In contrast, both *T. incisa* and *T. vivipara* are glabrous (except on the axes). Fée's illustration of the type appears to match the Mesoamerican plants in cutting of the lamina and abundance of long hairs.

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New Species of *Ruellia* (Acanthaceae) from the Venezuelan Guayana

Dieter C. Wasshausen
Department of Botany, National Museum of Natural History,
Smithsonian Institution, Washington, D.C. 20560, U.S.A.

ABSTRACT. Recent expeditions in the Venezuelan Guayana have resulted in additional new taxa in the genus *Ruellia* (Acanthaceae). The following places these novelties on record for the convenience of other taxonomists prior to the publication of the *Flora of the Venezuelan Guayana*. Five new Venezuelan species of *Ruellia*, *R. wurdackii*, *R. steyermarkii*, *R. delascioi*, *R. liesneri*, and *R. bolivarensis*, are described, illustrated, and compared with their closest relatives.

Ruellia L. is the second largest genus of Acanthaceae, with approximately 250 species of perennial herbs and shrubs with a pantropical distribution. The genus, named for Jean de la Ruelle (1474–1537), a French physician and herbalist, exhibits large and usually showy flowers borne either singly or in various inflorescence forms, which are either axillary or terminal or both. The funnelform or salverform corollas are either red, yellow, white, or purple (mauve) with a narrow tube and an often campanulate limb with five spreading lobes. The genus is characterized by the four didynamous stamens each with bilocular anthers, which are usually muticous at the base. The capsules are either oblong or clavate, with the dissepiment remaining attached to the capsule wall at maturity. Each capsule contains between 4 and 20 plano-compressed, suborbicular seeds. These are provided with a mucilaginous coat that exhibits, after moistening, tapered, short trichomes with walls marked internally by rings or spirals (Long, 1970). In an attempt to identify recent collections of *Ruellia* from the Venezuelan Guayana, I have found five undescribed species of the genus.

Key to the Venezuelan Guayana Species of *Ruellia*

1a. Inflorescence paniculate, flowers borne on simple or dichotomously branched penduncles or flowers in clusters of 2–4 at the leaf axil.
  2a. Flowers axillary, sessile, verticillate and clustered.
    3a. Corolla narrowly infundibular, 25 mm long, white with violet veins; leaves petiolate, the blades ovate-oblong ..... *R. menthoides*
    3b. Corolla funnelform, 35–50 mm long, light pink to pale mauve or purple; leaves sessile to subsessile, the blades linear to narrowly lanceolate ..... *R. geminiflora* var. *angustifolia*
  2b. Flowers terminal and axillary, pedicellate, pedunculate, the peduncles 25–100 mm long.
    4a. Flowers terminating conspicuously long peduncles, these 70–100 mm long.
      5a. Corolla tube white, the limb 15 mm broad, the lobes obovate, ca. 6 mm long and wide; peduncles slender, curved ..... 1. *R. wurdackii*
      5b. Corolla tube scarlet or crimson, the limb 25–30 mm broad, the lobes oblong, 12 mm long, 5–6 mm wide; peduncles rather stout, erect-ascending ..... *R. macrophylla*
    4b. Flowers not terminating on conspicuously long peduncles, these 25–60 mm long (if peduncle is more than 40 mm long then inflorescence is a terminal panicle 60–130 mm long).
      6a. Corolla yellow, greenish yellow, or pale green, the limb oblique.
        7a. Corolla pale green, 30–33 mm long, the lobes revolute-twisted with age; calyx segments narrowly ovate, 14–17 mm long, winged on the angles; leaf blades elliptic to oblong, 7–13 cm long and 3.5–5 cm wide ..... 2. *R. steyermarkii*
        7b. Corolla pale yellow or greenish yellow, 35–60 mm long, the lobes spreading with age; calyx segments linear-lanceolate, 25–30 mm long, membranous; leaf blades ovate or oblong-ovate, 18–30 cm long and 8.5–12 cm wide.
          8a. Corolla pale yellow, 50–60 mm long, 20 mm wide near the mouth; stamens exserted, not reflexed; leaf blades oblong-ovate, 26–30 cm long, 10.5–12 cm wide, narrowed at the base ..... *R. malaca*
          8b. Corolla greenish yellow, 35 mm long, 10 mm wide near the mouth; stamens exserted, reflexed; leaf blades ovate, 18–20 cm long, 8.5–9.3 cm wide, obtuse at the base ..... 3. *R. delascioi*
      6b. Corolla mauve, the limb regular ..... *R. tuberosa*
1b. Inflorescence spicate or a 2–3-flowered terminal fascicle.

9a. Flowers borne in terminal, 2–3-flowered fascicles or terminal, few-flowered, congested spikes.
10a. Corolla scarlet or red, 45–50 mm long; petioles 5–12 mm long, pilose and puberulous ..... 4. *R. liesneri*
10b. Corolla white, 60–80 mm long; petioles 3–5 mm long, puberulous ..... *R. sprucei*
9b. Flowers borne opposite in pairs on lax, axillary and terminal spikes ..... 5. *R. bolivarensis*

1. **Ruellia wurdackii** Wasshausen, sp. nov. TYPE: Venezuela. Bolívar: Río Parguaza, at base of Piedra Mapollos, E bank of river about 10 km above El Carmen (about 60 river km from mouth), 110 m, 2 Jan. 1956, *J. J. Wurdack & J. V. Monachino 41082* (holotype, US; isotype, NY). Figure 1E–G.

Suffrutex caulibus quadrangularibus, angulis rotundatis. Folium lamina oblongo-elliptica vel ovata, graciliter acuminata, basi angustata in petiolum decurrenti, membranacea, supra atroviridi, subtus pallide viridi costa et venis prominentibus, utrinque glabra; petiolo glabro. Inflorescentiae ex cymis dichotomis constantes; pedunculis gracilibus, glabris vel parce puberulis; bracteolis anguste oblongis glabris vel puberulis et parce glanduloso-pilosis; calycis segmentis inaequalibus, anguste linearibus, glanduloso-pilosis; corollae tubo albo, leviter curvato, limbo suberecto, purpureo, ad basim pallide luteo lobis obovatis, rotundatis; staminibus inclusis.

Shrub or suffrutescent herb; stems unbranched, 25–40 cm tall, quadrangular, 1–1.5 mm wide, the angles rounded. Leaves petiolate, petioles about 10 mm long, glabrous, narrowly winged, the blades oblong-elliptic to ovate, 8–11 cm long and 2.5–4 cm wide, long, slenderly acuminate at apex, attenuate, membranous, entire or shallowly crenate, rather thin, the upper surface dark green, glabrous, the lower surface paler green, glabrous, the costa and lateral veins (about 7 pairs) somewhat more conspicuous underneath, the cystoliths numerous and conspicuous under a lens. Flowers borne in lax dichotomously branched cymes, the peduncles slender, curved, subquadrangular, about 70 mm long, glabrous or sparingly and inconspicuously puberulous, the primary branches 1.5–2.5 cm long, puberulous, the trichomes erect, occasionally gland-tipped; bracteoles narrowly oblong, 3.5–4 mm long, 0.75 mm wide, glabrous to puberulous and sparingly glandular-pilose, the pedicels 2 mm long, subquadrangular, puberulous, the trichomes minute and erect; calyx segments unequal, narrowly linear, 11–14 mm long, 1 mm wide, glandular-pilose, the trichomes spreading, 0.5–2 mm long; corolla 46 mm long, the tube white, slightly curved, 32 mm long, 1.6 mm broad at base, narrowed to 1 mm at 1 mm above base, the throat turned up from the tube, 8 mm wide, the limb suberect, purple with darker spots on the lower portion, pale yellow at base, the lobes obovate, about 6 mm long and wide, rotundate; stamens included, about 8 mm long; pollen sphe-roidal, 92 μm diam., the reticulum homobrochate, membrane granular (Fig. 3A, B). Capsule clavate, 1.2 cm, 2.5 mm wide and thick, narrowed at the base, the solid portion 4.5 mm long, apically obtuse, minutely and sparingly puberulous, upward the trichomes are intermixed with a few glands. Mature seeds wanting.

Distribution. Occasional in forests and understory in Amazonian Venezuela and Brazil at elevations between 70 and 250 m.

Paratypes. VENEZUELA. TERRITORIO FEDERAL AMAZONAS: Depto. Atures, road Puente Cataniapo–Gavilán, 20–25 km SE of Puerto Ayacucho, 90 m, *P. J. M. Maas & O. Huber 5094* (U, US); carretera vía a Gavilán puente de Paso del Diablo hasta 2 km más adelante, sur-este de Puerto Ayacucho, 5°30′N, 67°27′W, 70–80 m, *Francisco Guánchez 274* (US). BRAZIL. PARÁ: Serra dos Carajás, 8.5 km W of AMZA camp N-1 on road to Río Itacaiúnas, 5°59′S, 50°20′W, 250 m, *C. R. Sperling, R. S. Secco, M. Condon, A. L. Mesquita, B. G. S. Ribeiro & L. R. Marinho 5795* (NY).

Ruellia wurdackii is related to another Venezuelan species, *R. pterocaulon* Leonard. In *R. pterocaulon* the corolla is 25 mm long, the corolla tube is lavender, erect, 15 mm long, the leaf blades are firm and rigid, nitid, acuminate with an obtuse tip, and the stem is about 100 cm tall and 3 mm wide. In contrast, the corolla of *R. wurdackii* is 46 mm long, the corolla tube is white, slightly curved, 32 mm long, the leaf blades are membranous, dark green above, paler green below, long, slenderly acuminate, and the stem is 25–40 cm tall and 1–1.5 mm wide.

2. **Ruellia steyermarkii** Wasshausen, sp. nov. TYPE: Venezuela. Bolívar: Altiplanicie de Nuria, cloud forest on summit of SE-facing escarpment, E of Cerro El Picacho, N of Las Nieves and Las Chicharras, 45 km N of Tumeremo, vicinity of Deborah, 600–650 m, 5–8 Feb. 1961, *Julian A. Steyermark 89113* (holotype, US; isotypes, NY, VEN). Figure 2A–G.

Frutex volubilis caulibus subteretibus, simplicibus vel ramosis, glabris. Folium lamina elliptica vel oblonga, breviter acuminata, basi angustata, subcoriacea vel membranacea, supra atroviridi, subtus pallide viridi costa et venis prominentibus, utrinque glabra; petiolo glabro. Inflorescentiae ex paniculis terminalibus, puberulis constantes; pedunculis puberulis; bracteolis oblanceolatis, glabris, ciliolatis; calycis segmentis atrovirentibus, anguste ovatis,

Figure 1. A–D. *Ruellia menthoides* (Nees) Hiern (*F. Guánchez 1954*). —A. Habit. —B. Bract. —C. Bracteole and calyx segments. —D. Corolla. E–G. *Ruellia wurdackii* Wasshausen (*Wurdack & Monachino 41082*). —E. Habit. —F. Bracteoles and calyx segments. —G. Calyx segments and corolla.

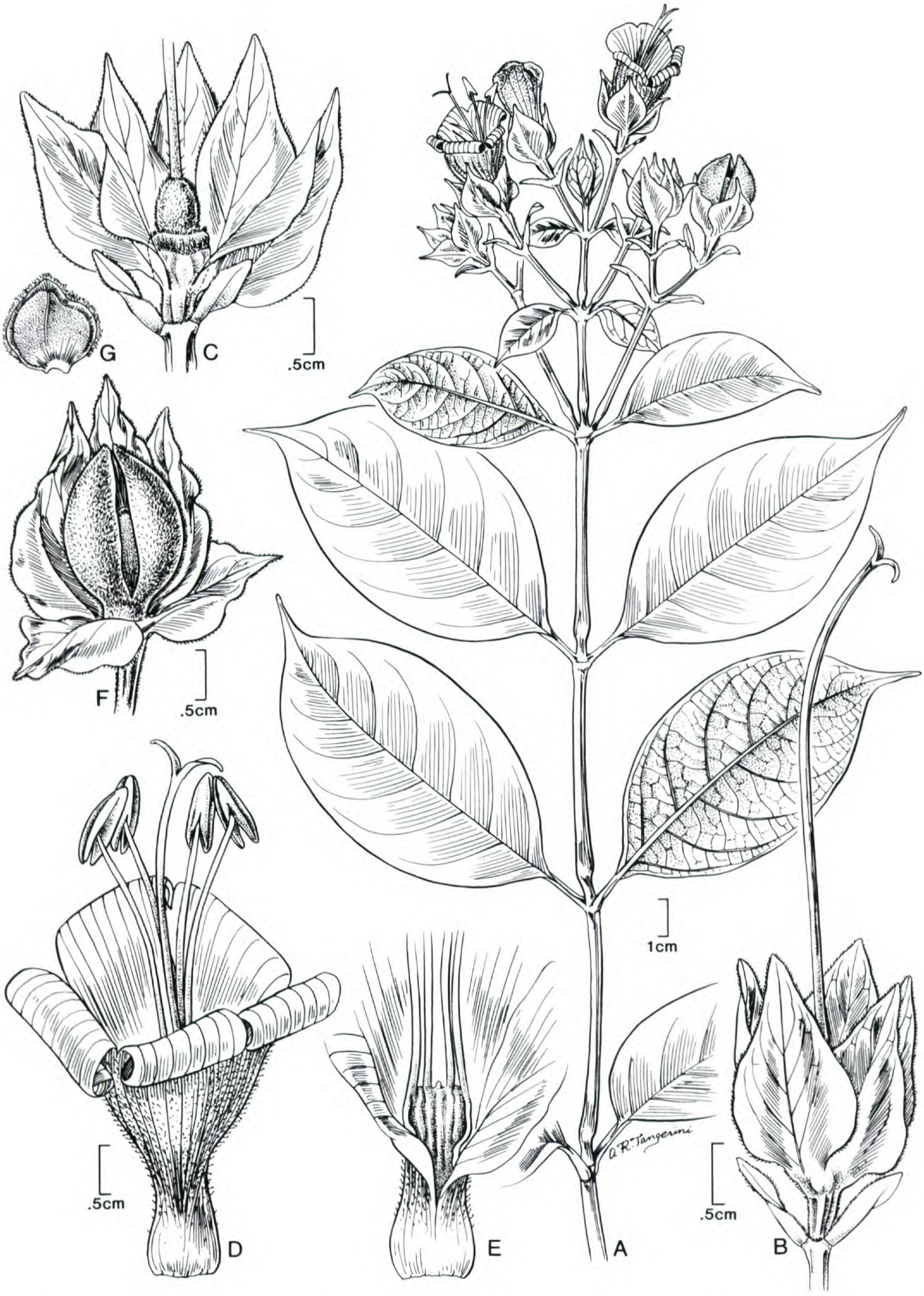

Figure 2. A–G. *Ruellia steyermarkii* Wasshausen (*J. A. Steyermark 88995*). —A. Habit. —B. Bracteoles, calyx segments, and pistil. —C. Bracteoles, calyx segments, and ovary. —D. Corolla, stamens, and pistil. —E. Expanded corolla showing attachment of filaments. —F. Calyx segments and capsule. —G. Seed.

glabris, ciliatis; corolla pallide viridi, parce puberula, tubo leviter curvato, limbo obliquo, lobis vetustate revolutotortis, suborbicularibus; staminibus exsertis. Capsulae ovoideae, obtusae et apiculatae.

Vining subsprawling; stem erect, simple or branching, glabrous, brownish, subterete. Leaves petiolate, the petioles 0.5–1.5 cm long, canaliculate, glabrous; the blades elliptic to oblong, 7–13 cm long and 3.5–5 cm wide, short-acuminate at apex, narrowed at base, subcoriaceous or membranous, entire or undulate, both the upper and lower surface glabrous, dark green above, paler green below, the costa and lateral veins (4–6 pairs) conspicuous below, less so above, the cystoliths barely visible under a lens on the upper surface. Panicle terminal, 6–9 cm long and 6–7 cm wide, puberulous, the trichomes brownish, eglandular, the peduncles 2.5–3.5 cm long, puberulous; bracteoles oblanceolate, 12–14 mm long, 2–3 mm wide, glabrous and ciliolate; calyx grass green, winged on the angles, the segments narrowly ovate, 14–17 mm long, 7–8 mm wide, acuminate, glabrous and ciliolate, the cystoliths conspicuous under a lens; corolla pale green without, buff-green within on the lobes, sparingly puberulous with both glandular and eglandular trichomes, 30–33 mm long, the tube sometimes slightly curved, basally 4 mm wide, near mouth 15 mm wide, the limb oblique, 22–25 mm wide, the lobes revolute-twisting with age, suborbiculate, 9 mm long, 11 mm wide; stamens exserted, to 45 mm long; filaments greenish white, glabrous; anthers buff-brown, oblong, 8 mm long, 2 mm wide, glabrous, basal lobe 7 mm long; pollen spheroidal, 91 μm diam., the reticulum homobrochate, the membrane granular (Fig. 3C, D); ovary soft tomentose, the trichomes brownish; style greenish white, slender, exserted about 30 mm beyond mouth of the corolla. Capsule ovoid, 20 mm long, 10 mm wide, obtuse and apiculate at apex, puberulous, the trichomes appressed; seeds flat, 6 mm long and wide, minutely moss-like-puberulous when moistened; retinacula subcarinate, curved, 5 mm long, 0.5 mm wide, erose at tip.

Distribution. Steep moist forested slopes over boulders just below summit and on ridge on summit at elevations between 200 and 650 m.

Paratypes. VENEZUELA. BOLÍVAR: Río Toro (Río Grande), between Río La Reforma and Puerto Rico, N of El Palmar, 200–250 m, *Julian A. Steyermark 88139* (VEN); Cerro El Picacho and vicinity, N of Las Chicharras, 45 km N of Tumeremo Altiplanicie de Nuria, 300–620 m, *Julian A. Steyermark 88995* (NY, US, VEN); Camp "El Paraiso" and "La Yugua," 48 km NE of village Los Rosos, E end of 17 km of Upata, *Carlos Blanco 447* (US).

Ruellia steyermarkii is perhaps most closely related to another Venezuelan Guayana species, *R. malaca* Leonard, which differs markedly by having linear-lanceolate calyx segments; pale yellow corollas 50–60 mm long; and oblong-ovate, 26–30-cm-long, 10.5–12-cm-wide leaf blades. In contrast, *R. steyermarkii* has narrowly ovate, winged on the angles calyx segments; pale green without, buff-green within corollas, 30–33 mm long; and elliptic to oblong, 7–13 cm long, and 3.5–5 cm wide leaf blades.

3. **Ruellia delascioi** Wasshausen, sp. nov. TYPE: Venezuela. Territorio Federal Amazonas: Depto. Atabapo, Salto Yureba, Bajo Ventuari, 4°3′N, 66°1′W, 120–150 m, 24 Oct.–4 Nov. 1981, *Francisco Delascio & Francisco Guánchez 10693* (holotype, US). Figure 4A–C.

Suffrutex caulibus erectis, simplicibus vel ramosis, tomentosis. Folium lamina ovata, breviacuminata, basi obtusa, aliquanto firma, utrinque molliter hirtella; petiolo dense tomentoso vel minute puberulo. Inflorescentiae ex paniculis terminalibus, dense puberulis constantes; pedunculis dense et molliter tomentosis; bracteolis persistentibus, dense puberulis. Flores persistentes; calycis segmentis firmis, lineari-lanceolatis, longo-acuminatis, dense puberulis, costa et venis obscuris; corolla minute glanduloso-puberula, viridi-flava, tubo curvato, limbo obliquo, lobis rotundatis; staminibus reflexis.

Shrub or subshrub; stem erect, simple or branching, grayish, subquadrangular, densely and softly tomentose. Leaves petiolate, the petioles 3.5–5 cm long, densely tomentose or minutely puberulous, the blades ovate, 18–20 cm long and 8.5–9.3 cm wide, short-acuminate at apex, obtuse at base and briefly decurrent on the petiole, firm, entire or undulate, the upper surface softly hirtellous, drying dark green, the trichomes erect, the lower surface paler green, softly hirtellous, the trichomes erect, grayish, the costa and lateral veins (6–8 pairs) rather prominent, especially below, the cystoliths inconspicuous under a lens. Panicle terminal, 6 cm long and wide, densely puberulent, the trichomes eglandular; peduncle 60 mm long, densely and softly tomentose; bracteoles persistent, oblong, 3.7 cm long, 8–9 mm wide, densely puberulent; flowers persistent; calyx segments firm, linear-lanceolate, about 3 cm long, 4 mm wide, long-acuminate, densely puberulent, the costa and veins obscure; corolla minutely glandular puberulent, greenish yellow, 35 mm long, the tube slightly curved, 3 mm wide at base, 10 mm wide near the mouth, the limb oblique, 20 mm wide, the lobes oblong, 7 mm wide, rotundate; stamens exserted and reflexed; filaments puberulous; anthers

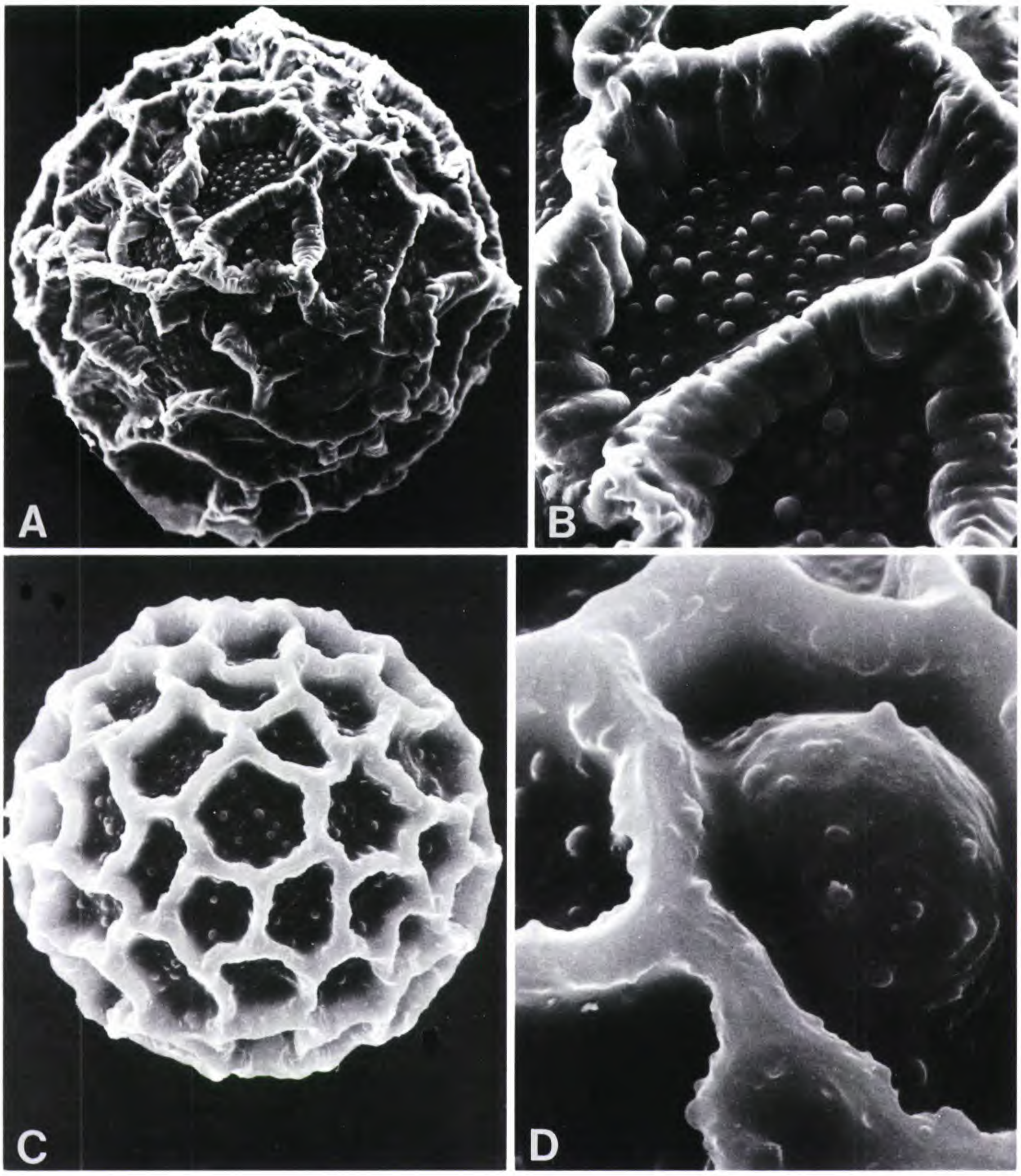

Figure 3. Scanning electron (SEM) photomicrographs of *Ruellia* pollen. A–B. *R. wurdackii* (*F. Guánchez 274*). —A. Equatorial view, ×700. —B. Portion of surface ×2,000. C–D. *R. steyermarkii* (*J. A. Steyermark 89113*). —C. Equatorial view, ×800. —D. Portion of surface ×3,000.

oblong, 10 mm long, 2 mm wide, glabrous, basal thecae 6 mm long. Capsule wanting.

Distribution. Known only from the type locality.

Ruellia delascioi superficially resembles *R. malaca* Leonard from the Venezuelan Guayana. However, in *R. malaca* the pale yellow corolla is 50–60 mm long, 20 mm wide near the mouth, the stamens are exserted but not reflexed, and the leaf blades are oblong-ovate, 26–30 cm long, 10.5–12 cm wide, and narrowed at base. In contrast, in *R. delascioi* the greenish yellow corolla is 35 mm long, 10 mm wide near the mouth, the stamens are both exserted and reflexed, and the leaf blades are ovate, 18–20 cm long, 8.5–9.3 cm wide, and obtuse at base.

Figure 4. A–C. *Ruellia delascioi* Wasshausen (*Delascio & Guánchez 10693*). —A. Habit. —B. Calyx segments. —C. Corolla and stamens. D–F. *Ruellia liesneri* Wasshausen (*R. Liesner 25638*). —D. Habit. —E. Leafy bracts and calyx segments. —F. Corolla and stamens.

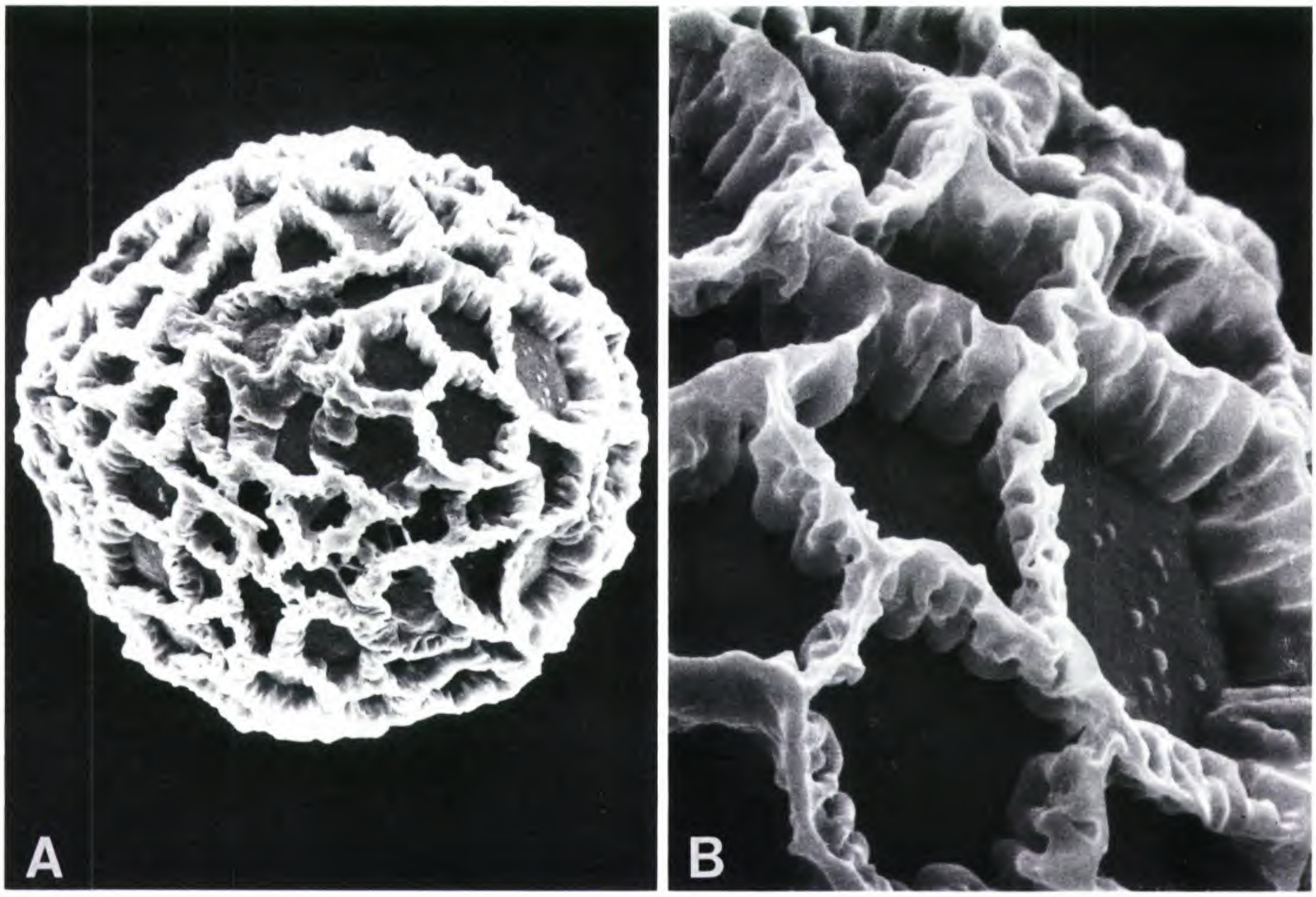

Figure 5. Scanning electron (SEM) photomicrographs of *Ruellia* pollen. A–B. *R. liesneri* (*N. Cuello 400*). —A. Equatorial view, ×1,000. —B. Portion of surface ×3,000.

4. **Ruellia liesneri** Wasshausen, sp. nov. TYPE: Venezuela. Territorio Federal Amazonas: Depto. Atabapo, E slope of Cerro Huachamacari, 3°49′N, 65°42′W, 600–700 m, 2 Nov. 1988, *Ronald Liesner 25638* (holotype, US; isotype, MO). Figure 4D–F.

Herba volubilis caulibus ascendentibus, subquadrangularibus, parce pilosis et puberulis. Folium lamina oblonga vel anguste ovata, acuminata, basi rotundata, membranacea, atrovirenti, utrinque pilosa. Inflorescentia ex fasciculo terminali 2–3-floro bracteis foliaceis subtento constans; pedicellis strobilaceis, molliter et dense pilosis; bracteolis foliaceis, anguste lanceolatis, dense pilosis. Flos calycis segmentis lanceolatis, pilosis et glanduloso-punctatis; corolla coccinea, parce pilosa, glanduloso-punctata, hypocrateriformi, tubo curvato et ventricoso, lobis oblongo-ovatis, emarginatis; staminibus exsertis. Capsulae clavatae, puberulae, glanduloso-punctatae, apice subobtusae.

Clambering herbs 0.3–2 m high; stems ascending, subquadrangular, sparingly pilose and puberulous, the pilose trichomes erect, 1.5 mm long, puberulous trichomes (inconspicuous) appressed. Leaves petiolate, the petioles 5–12 mm long, pilose and puberulous, the pilose trichomes whitish, erect, 2 mm long, the blades oblong to narrowly ovate, 4.5–10 cm long and 2.5–4 cm wide, acuminate at apex, rounded at base, entire, undulate or shallowly crenate, rich green, membranous, both surfaces pilose, the trichomes ± erect, soft, prominent on the costa and lateral veins (7–9 pairs), the cystoliths inconspicuous under a lens. Fascicle terminal, 2–3-flowered, subtended by leafy bracts 2.5–3 cm long and 0.8–1.2 cm wide; pedicels conelike, 1–3 mm long, softly and densely pilose; bracteoles leaflike, narrowly lanceolate, 10 mm long, densely pilose; calyx 5–9 mm long, pilose and gland-dotted, the segments lanceolate, 4.5–8 mm long, 0.8–1 mm wide, pilose and gland-dotted; corolla scarlet or red, sparingly pilose, gland-dotted, 45–50 mm long, salverform, the tube slightly curved and ventricose, 2–3 mm broad at base, slightly narrowed above the ovary, thence gradually enlarged to about 7 mm at mouth, the limb 25–35 mm broad, the lobes oblong-ovate, 13 mm long and 10 mm wide near the tip, emarginate; stamens exserted 8–10 mm beyond mouth of the corolla tube; filaments sparingly and inconspicuously pilose; anthers oblong, 3 mm long, 1.5 mm wide, sparingly and inconspicuously pilose; pollen spheroidal, 65 μm diam., the reticulum homobrochate, the membrane mostly smooth (Fig. 5A, B); the pistil exceeding the stamens, glabrous. Cap-

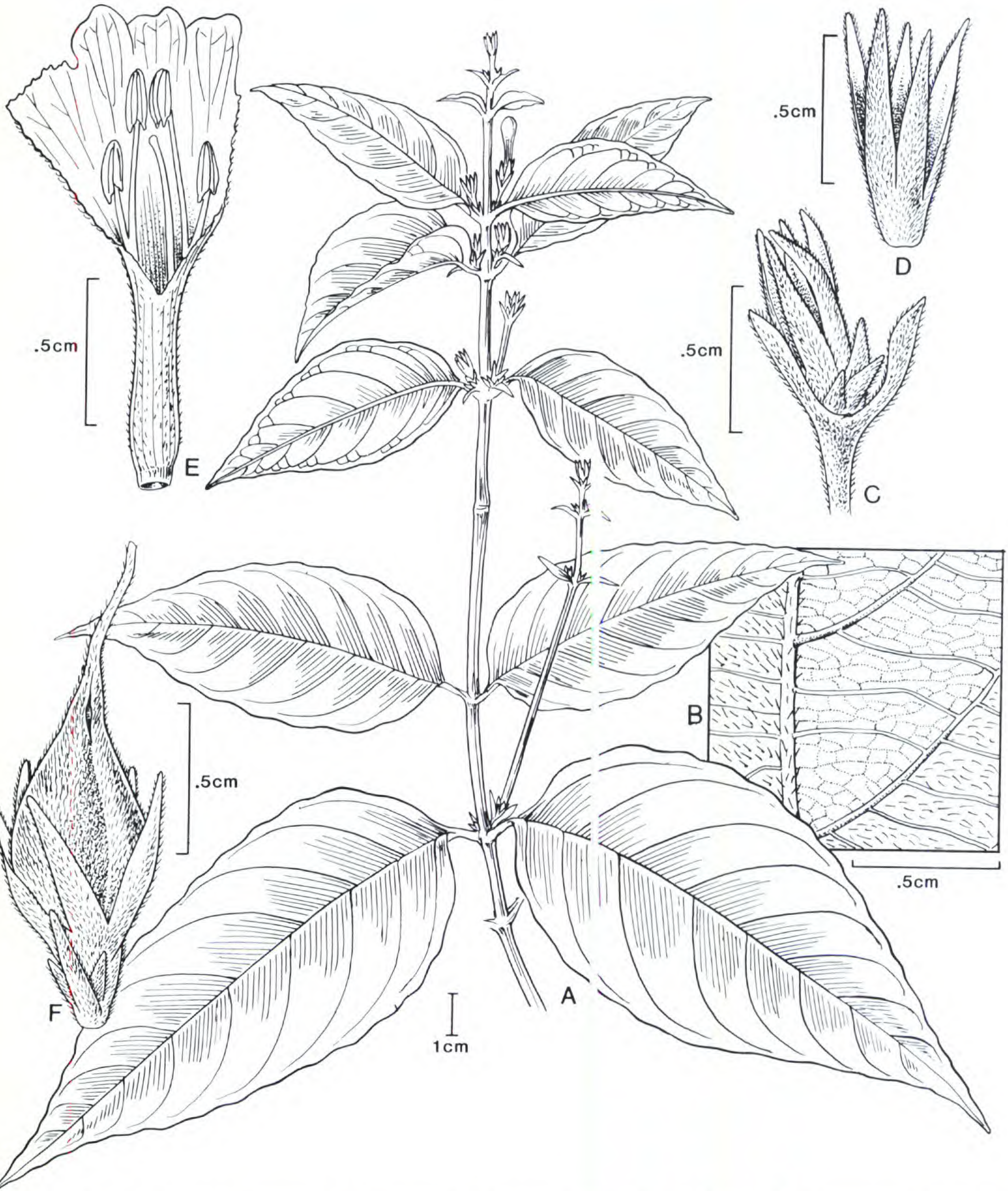

Figure 6. A–F. *Ruellia bolivarensis* Wasshausen (*F. Cardona 49?*). —A. Habit. —B. Enlargement of lower leaf surface. —C. Bracts, bracteoles, and calyx segments. —D. Calyx segments. —E. Expanded corolla, stamens, and pistil. —F. Bract, bracteoles, calyx segments, and capsule.

sule clavate, puberulous, gland-dotted, 15 mm long, 5 mm broad, rather bluntly pointed, narrowed to a slender, solid base about 3 mm long; seeds brown, appressed-puberulous, about 5 mm long and 4 mm wide.

Distribution. Open and forested areas around waterfall and on forested areas and igneous outcrops at elevations between 80 and 750 m.

Paratypes. VENEZUELA. TERRITORIO FEDERAL AMAZONAS: Depto. Atabapo, slope of Huachamacari, 3°39′N, 65°42′W, 750 m, *Ronald L. Liesner 18378* (MO, US); Depto. Atures, 35 km SE of Puerto Ayacucho, along Río Coromoto, at Tobogán de la Selva, 5°22′N, 67°33′W, 100 m, *Steyermark, Davidse & Guánchez 122508* (MO, NY, US); forest 1 km below Tobogán de la Selva, 80 m, *Steyermark, Holst & Manara 131550* (MO, US); Serranía de la Coromoto, sector "El Tobogán," 37 km S of Puerto Ayacucho, 5°24′N, 67°35′W, 80–200 m, *Nidia Cuello 400* (US).

Ruellia liesneri is related to the widespread Venezuelan and Colombian species *R. humboldtiana* (Nees) Lindau. In *R. humboldtiana* the inflorescence is a thyrsoid panicle, with the branches each bearing from several to 20 or more flowers, these not subtended by any conspicuous, leafy bracts, the calyx 9–12 mm long, and with petioles 10–15 mm long, puberulous. In contrast, the inflorescence of *R. liesneri* is a 2–3-flowered fascicle, subtended by conspicuous, large, leafy bracts, the calyx 5–9 mm long, and the petioles are 5–12 mm long and both pilose and puberulous.

5. **Ruellia bolivarensis** Wasshausen, sp. nov. TYPE: Venezuela. Bolívar: Sitio Parupa, río Paragua, Apr. 1943, *Felix Cardona 492* (holotype, US). Figure 6A–F.

Herba vel suffrutex caulibus quadrangularibus, sulcatis, parce pilosis. Folium lamina oblonga vel ovata, graciliter acuminata, basi rotundata, firma, praeter costam et venas pilosas glabra. Inflorescentiae ex spicis terminalibus laxis, flores in paribus oppositis gerentibus constantes, internodiis glabris vel parce pubescentibus; bracteis foliaceis quam foliis multo minoribus, oblongis; bracteolis anguste triangularibus. Flos calycis segmentis subulatis, pilosis; corolla anguste infundibuliformi, tubo curvato, lobis suborbicularibus, ad apicem irregulariter lobulatis; staminibus inclusis, antheris mucronulatis, glabris. Capsulae clavatae, puberulae, ad apicem acutae.

Plants herbaceous or suffrutescent; stems quadrangular, shallowly sulcate, the angles narrowly winged, the wings pilose, the trichomes barely 1 mm long, the cystoliths minute. Leaves petiolate, the petioles 5–15 mm long, minutely pilose, the blades oblong to ovate, 9–14 cm long, 3.3–6.4 cm wide, rather slenderly acuminate, distinctly rounded at base, firm, shallowly crenate, glabrous except the costa and lateral veins (5 or 6 pairs), these pilose, the trichomes about 0.5 mm long, spreading or subappressed, the cystoliths conspicuous under a lens on the upper surface. Flowers borne opposite in pairs on lax, nearly straight, rigid, ascending axillary and terminal spikes 2.5–8.5 cm long, the lowermost internodes 3 cm long, the others successively shorter, somewhat flattened near the nodes, glabrous or sparingly pubescent, the trichomes ascending to subappressed, about 0.2 mm long; bracts leaflike but much smaller, oblong, narrowed at both ends, 11 mm long and 2 mm wide; bracteoles narrowly triangular, 1 mm long, sparingly pilose; calyx 6–7 mm long, the segments subulate, 4–5 mm long, 0.75–1 mm wide at base, pilose, consisting of both glandular and eglandular trichomes, these erect or spreading; corolla 12–14 mm long, inconspicuously pilose, narrowly infundibular, the narrow portion of the tube slightly curved, 6–7 mm long, 1 mm broad at base, the limb about 4.5 mm wide, the lobes suborbicular, about 2 mm diam., irregularly lobulate at apex; stamens barely reaching the base of the corolla lobes; anther oblong, mucronulate, the upper pair 1.5 mm long, 0.5 mm wide, glabrous, the lower pair 1 mm long, 0.3 mm wide. Capsule slenderly clavate, about 13 mm long, puberulous, pointed at apex, the slender sterile basal portion about 6 mm long and 1 mm broad at base, enlarging to 1.25 mm at base of seed-bearing cavity, this flattened and about 2 mm broad; retinacula slender, curved, about 1.75 mm long, the slender tip ± erose.

Distribution. Known only from the type locality.

Ruellia bolivarensis superficially resembles *R. menthoides* (Nees) Hiern from Amazonian Venezuela and Brazil. However, in *R. menthoides* (Fig. 1A–D) the flowers are borne axillary, sessile, clustered, and verticillate; the corollas are 25 mm long, and the upper leaf blades are narrowed and acute at base. In contrast, in *R. bolivarensis* the flowers are borne opposite in pairs on lax, axillary and terminal spikes; the corollas are 12–14 mm long, and the upper leaf blades are distinctly rounded at base. This new taxon is unique from the other known species of neotropical *Ruellia*. It possesses mucronulate anther lobes, which thus far have not been reported for this genus in the literature, and a rather long, pointed capsule. Unfortunately, the single *Cardona 492* collection is somewhat scanty; additional specimens should be collected for a proper diagnosis of these character states.

Acknowledgments. My special thanks to Alice Tangerini, who skillfully prepared the line drawings, and to Stephen F. Smith and the staff of the National Museum of Natural History SEM Laboratory for their high-quality pollen photomicrographs.

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Nomenclatural Changes in the Acanthaceae and Two New Species of *Odontonema* from Venezuela and Guyana

Dieter C. Wasshausen

Department of Botany, National Museum of Natural History,
Smithsonian Institution, Washington, D.C. 20560, U.S.A.

ABSTRACT. The recent completion of the Acanthaceae treatment for the *Flora of the Venezuelan Guayana* has necessitated a new name in the genus *Staurogyne*, a new combination in *Anisacanthus*, and the recognition of two undescribed species of *Odontonema*, based on relatively recent collections.

Staurogyne spraguei Wasshausen, nom. nov. Replaced name: *Staurogyne leptocaulis* Leonard, Contr. U.S. Natl. Herb. 31: 671. 1958, not *S. leptocaulis* Bremek. 1957. TYPE: Colombia. Meta: *T. A. Sprague 27* (holotype, K).

Anisacanthus boliviensis (Nees) Wasshausen, comb. nov. Basionym: *Drejera boliviensis* Nees in DC., Prodr. 11: 334. 1847. TYPE: Bolivia. *Orbigny 786* (lectotype, designated here, G; isolectotype, GZU). [The syntypes, *Otto 1009* (Venezuela) and *Hostmann 1123* (Surinam), are *Anisacanthus secundus* Leonard.]

Schaueria caduciflora Griseb. in Symb. Fl. Argent. 261. 1879. *A. caduciflorus* (Griseb.) Ariza in Bol. Soc. Argent. Bot. 22(1/4): 255. 1983. TYPE: Argentina. Gran Chaco: Laguna del Palmar, *Lorentz & Hieronymus 554* (holotype, GOET).

Jacobinia caducifolia Griseb. in Symb. Fl. Argent. 261. 1879. *Anisacanthus caducifolius* (Griseb.) Lindau in Bot. Jahr. 19, Beibl. 48: 18. 1894. TYPE: Argentina. Oran, Tabacal, *Lorentz & Hieronymus 926* (holotype, GOET).

Odontonema liesneri Wasshausen, sp. nov. TYPE: Venezuela. Territorio Federal Amazonas: Depto. Río Negro, Cerro de La Neblina Camp V, valley N base of Pico Cardona, 0°49′N, 66°0′W, 1,250 m, 21–24 Mar. 1984, *Ronald Liesner & Brian Stannard 16910* (holotype, US; isotype, MO). Figure 1A–F.

Frutex caulibus juvenilibus subquadrangularibus, glabris. Folium lamina oblonga vel elliptica, acuta vel acuminata, basi angustata et in petiolum decurrenti, membranacea, utrinque minute et parce puberula; petiolo parce puberulo. Racemi terminales, graciles, rhachi sicut pedicello puberula; bracteis lineari-lanceolatis; bracteolis anguste triangulatis, minute puberulis. Flos calycis segmentis anguste triangularibus; corolla rubra, glabra vel minute glanduloso-pubescenti, labiis subaequalibus, superiore bilobo lobis ellipticis vel late oblongis, inferiore prope basim trilobo lobis loborum superiorum similibus; staminibus vix exsertis.

Plants fruticose, 1–1.5 m tall, the stems terete in older portions to subquadrangular in younger portions, glabrate. Leaves petiolate, the petioles 10–20 mm long, minutely and inconspicuously puberulous with appressed trichomes, the blades oblong-elliptic, 16–30 × 6.5–11 cm, acute to acuminate at apex, narrowed at base and decurrent on the petiole, thin, membranous, minutely and inconspicuously puberulous on both surfaces especially along the midrib and lateral veins of the upper leaves, the margins entire to crenate, the cystoliths minute and scattered on the upper surface, visible only under a lens; inflorescence a loose, slender, terminal raceme 10–22 cm long with 1 or 2 flowers per node, the rachis puberulous, the pedicels 2–4 mm long, minutely puberulous; the bracts subtending the rachis linear-lanceolate, the lowermost pair 5.5–9 × 0.8 mm, the others successively reduced upwardly, the bracts subtending the pedicels narrowly triangular, 2 × 0.6 mm; bracteoles 2 per flower, narrowly triangular, 1 × 0.5 mm, all minutely puberulous; calyx segments narrowly triangular, 2 × 0.8 mm, acute, sparingly to moderately puberulous; corolla red, narrowly urceolate, 15–25 mm long, 1–2 mm wide at base, 3–4 mm wide at throat, glabrous to inconspicuously glandular-puberulent without, puberulent within, the lips similar, the upper lip with elliptic to broadly oblong lobes, 3 × 2 mm, the lower lip with similar lobes 2.5–3 × 2 mm; stamens extended to the edge of the corolla lips, the filaments glabrous, 12 mm long (heterostyly is known to occur in many species of *Odontonema;* however, only one morph is currently known from this taxon), the anthers 3.5 mm long; staminodes 1 mm long, glabrous; pistil exserted, the stigma minutely bilobed, the style 20 mm long, glabrous; ovary glabrous. Capsule not seen.

Distribution. Noted as locally common, but known only from the type locality, Cerro Neblina in southern Venezuela.

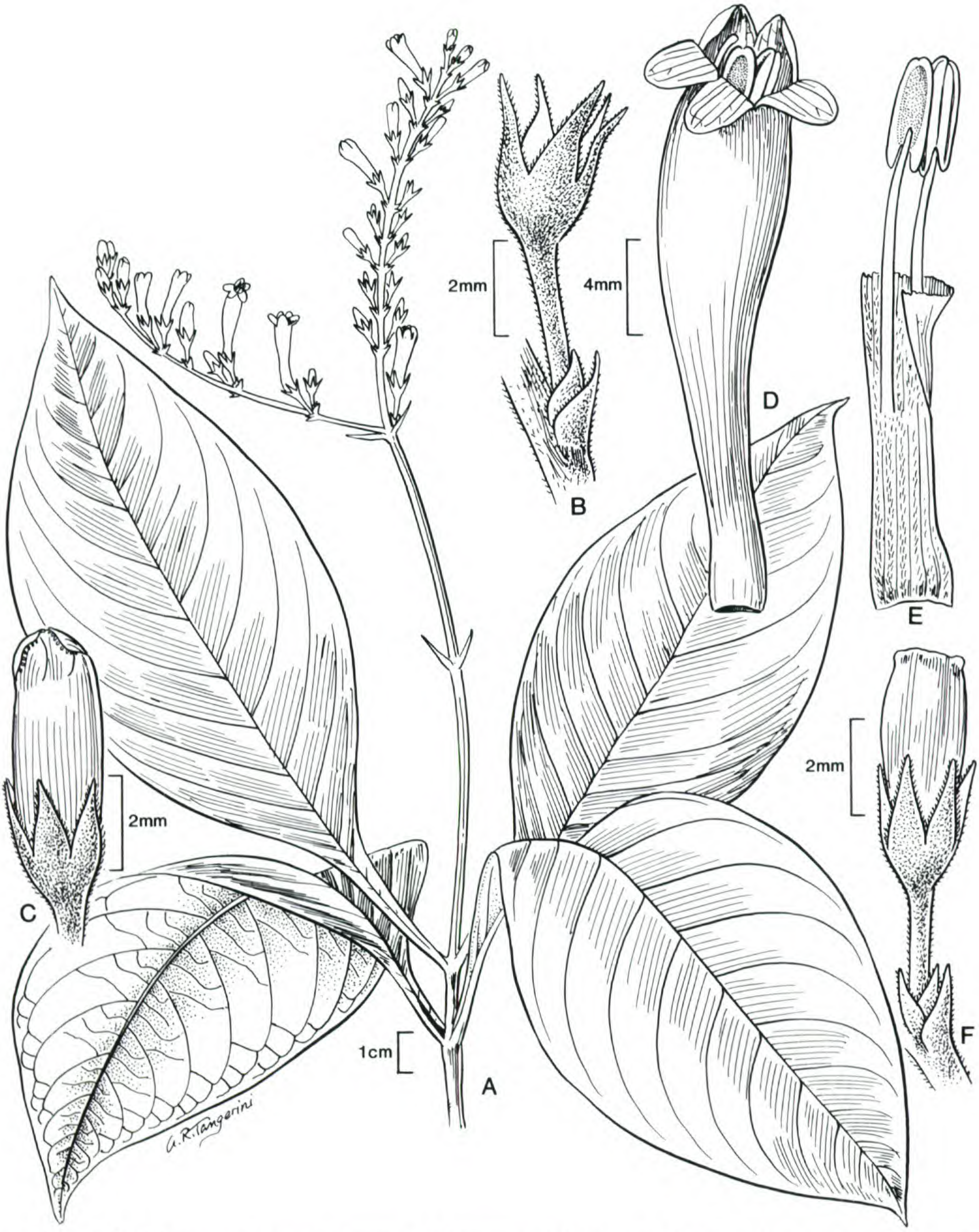

Figure 1. A–F. *Odontonema liesneri* (*Liesner & Stannard 16910*). —A. Habit. —B. Bract, bracteole, pedicel, and calyx. —C. Calyx and juvenile corolla. —D. Corolla. —E. Corolla tube and stamens. —F. Bract, bracteoles, pedicel, calyx, and juvenile corolla.

Odontonema liesneri resembles *O. fuchsioides* (Nees) Kuntze from the coastal regions of northern Colombia. However, in *O. fuchsioides* the leaf blades are rather firm, 9–12.5 × 2–6 cm, the corollas are 25–30 × 5–6 mm at the throat, and the calyx segments are 5 × 1 mm. In contrast, *O. liesneri* has leaf blades that are thin and 16–30 × 6.5–11 cm, the corollas are 15–25 × 3–4 mm at the throat, and the calyx segments are 2 × 0.8 mm.

Odontonema mazarunensis Wasshausen, sp. nov. TYPE: Guyana. Upper Mazaruni River region, Karowtipu Mountains, 5°45′N, 60°35′W, ca. 460 m, 26 Apr. 1987, *Brian*

Figure 2. A–D. *Odontonema mazarunensis* (*Boom & Gopaul 7748*). —A. Habit. —B. Bract subtending the rachis. —C. Bracteoles, pedicel, and calyx. —D. Corolla, stamens, and pistil.

Boom & Doorjoohan Gopaul 7748 (holotype, NY). Figure 2A–D.

Suffrutex caulibus juvenilibus subquadrangularibus, glabris. Folium lamina elliptica vel lanceolata, acuminata, basi angustata, firma, utrinque glabra vel in costa et venis lateralibus parce hirtella; petiolo brevi, glabro. Racemi terminales, breves, rhachi sicut pedicello rubra, puberula; bracteis rubris, lineari-lanceolatis, pilosis; bracteolis subulatis, minute pilosis. Flos calycis segmentis rubris, anguste lanceolatis, glanduloso-puberulis; corolla rubra, tubulosa, glanduloso-pubescenti, labiis subaequalibus, superiore bilobo, lobis ellipticis vel ovatis, inferiore prope basim trilobo lobis loborum superiorum similibus; staminibus exsertis, filamentis subroseis, antheris rubris.

Shrub 1 m tall, the stems terete in older portions to subquadrangular in younger portions, glabrate. Leaves short-petiolate, the petiole (unwinged portion) 5 mm long, glabrous, the blades elliptic-lanceolate, 23–24 × 6.2–8.2 cm, acuminate at apex, narrowed at base, entire or slightly crenulate, firm, glabrous above, glabrous below except for the costa and lateral veins (6–8 pairs), these sparingly hirtellous, the trichomes appressed. Inflorescence a short terminal raceme 3 cm long with 2 flowers per node, the rachis red, puberulous, the pedicel red, 4.5–6 mm long, glandular-puberulous; bracts subtending the rachis red, linear-lanceolate, the lowermost pair 14 × 1 mm, pilose, the bracts subtending the pedicel red, linear, 12 × 0.5 mm, glandular-puberulous; bracteoles subulate, 3 × 0.3 mm, minutely and inconspicuously pilose; calyx segments reddish, narrowly lanceolate, 6.5–7.5 × 1 mm, glandular-puberulous; corolla red, glandular-puberulent without, glabrous within, tubular, 40–50 mm long, the tube 3 mm wide at the base, 6.5–7 mm wide at the throat, the upper lip with elliptic-ovate lobes 5 × 3 mm, the lower lip with elliptic-ovate lobes 6 × 4 mm; stamens exceeding the corolla lobes by 5 mm, the filaments pinkish, 27 mm long, pubescent basally, the anthers red, 2.5 mm long; staminodes 2 mm long, retrorsely puberulous, apically capitate with a rudimentary anther; pistil exserted, the stigma minutely bilobed, glabrous, the style 45 mm long (heterostyly is known to occur in many species of *Odontonema;* however, only one morph is currently known from this taxon), sparsely pilose; ovary glabrous. Capsule not seen.

Distribution. Humid forest at the base of mountain. Known only from the Karowtipu Mountains, Guyana.

Odontonema mazarunensis is perhaps most closely related to the lowland Venezuelan species *O. album* V. M. Baum, which differs markedly by having a white corolla to 30 mm long, bracts subtending the pedicels lanceolate, 1–1.5 mm long, and the stamens extended to the edge of the corolla lobes. In contrast, *O. mazarunensis* has a red corolla 40–50 mm long, bracts subtending the pedicels red, linear, 12 mm long, and the stamens exceeding the corolla lobes by 5 mm.

Acknowledgment. My special thanks to Alice Tangerini for the skillfully prepared line drawings.

A New Species of *Aptandra* (Olacaceae) from Amazonian Peru

Alwyn H. Gentry and Rosa Ortiz
Missouri Botanical Garden, P.O. Box 299, St. Louis, Missouri 63166, U.S.A.

ABSTRACT. A new species of Olacaceae from Amazonian Peru is described as *Aptandra caudata*.

Aptandra caudata A. Gentry & Ortiz, sp. nov. TYPE: Peru. Loreto: Provincia Maynas, Quebrada Sucusari, N bank of Río Napo below Mazán, mature upland forest on lateritic soil, elev. 130 m, 3°15′S, 72°55′W, 7 July 1983 (fl), *Gentry, Vasquez & Jaramillo 42718* (holotype, MO; isotypes, AMAZ, USM). Figure 1.

Arbor parva, ramulis teretibus, glabris. Folia anguste elliptica vel elliptico-oblonga, apice abrupte per 1.5–3.5 cm caudata, glabra, membranacea. Inflorescentia pauciflora, pedicellis filiformibus, 1–1.5 mm longis. Flores in alabastro cylindrici, ca. 5 mm longi; calyce obtuse 4-lobulatos, 0.5 mm longo. Fructus globosus, ca. 2.5 cm diametro, calyce subpatelliformi expanso subtensus.

Treelet 3–5 m tall; branchlets slender, subterete, smooth, glabrous. Leaves narrowly elliptic or elliptic-oblong, the apex abruptly caudate-acuminate for 1.5–3.5 cm, the base ± cuneate, membranaceous, olive green when dry, glabrous, 3.5–15 cm long (excluding drip tip), 1.2–4.5 cm wide, the lateral nerves 6–14 pairs; petiole slender, 4–8 mm long, ca. 1 mm thick. Inflorescence an open axillary panicle, few-flowered, the branches slender, the peduncle ca. 1 cm long, the flowers arranged in 2–3-flowered umbels at ends of the inflorescence branches, the filiform pedicels ca. 1–1.5 cm long. Flower bud a cylindrical tube with globose apex; calyx shallowly and obtusely 4-lobed, ca. 5 mm long at anthesis, much enlarged in fruit; petals 4, linear below, somewhat broadened at apex, greenish cream, ca. 5 × 1 mm, forming a strictly cylindrical tube with a globose apex; stamens 4, the filaments connate into 4-mm-long tube, the anthers ca. 0.5 mm long, fused to an annulus, opening by a thin reflexing valve; pistil ca. 4 mm long, the slender style apically thickened at level of anthers. Fruit globose, single-seeded, green, ca. 2.5 cm diam., the fruiting calyx coriaceous, becoming broadly cup-shaped to almost patelliform, enveloping less than the basal quarter of drupe; seed globose, ca. 7 mm across.

Distribution. Known only from the type locality at the Explornapo Camp on the Río Sucusari in Loreto Department, Peru, 116–130 m elevation.

Additional collections examined. PERU. LORETO: (all from type locality), 5 July 1983 (fl), *Gentry et al. 42628* (AMAZ, MO, USM), 14 June 1986 (st), *Gentry et al. 54321* (AMAZ, MO), 7 Oct. 1986 (st), *Vasquez & Jaramillo 8156* (AMAZ, MO), 7 Nov. 1989 (fr), *Vasquez & Jaramillo 13103* (AMAZ, MO, USM).

Only three species of *Aptandra* were recognized by Sleumer (1984), two in the Neotropics and one in tropical Africa. Of these, *A. caudata* is closest to *A. tubicina* (Poeppig) Benth. ex Miers, which also occurs in Amazonian Peru, on account of the membranaceous, cuneate leaves and strictly cylindric pre-anthesis corolla tube. The most striking differentiating feature of *A. caudata* is the conspicuously caudate leaf apex, especially pronounced in small leaves where a 3-cm-long leaf can have a 1.5-cm-long drip tip. In contrast, *A. tubicina* is acuminate with the drip tip 0.5–1.5 cm long. The leaves of *A. caudata* are also narrower and more elliptic than in *A. tubicina;* although the latter sometimes has some leaves as narrow as those of *A. caudata*, the narrower leaves are mostly lanceolate. The flower of *A. caudata* is also noticeably longer (5 mm vs. 3 mm) than that of *A. tubicina* and has a more prominently globose bud apex and more shallowly and obtusely lobed calyx. Another difference is the almost patelliform fruiting calyx of *A. caudata*, which covers only the extreme base of the drupe and is very different from the broadly cupular calyx of *A. tubicina*, which covers most of the lower half of the drupe.

It is possible that two species are included in Sleumer's (1984) concept of *A. tubicina:* one with membranaceous to chartaceous, strongly acuminate leaves, which includes the type; the other with more subcoriaceous, subacuminate leaves and smaller, more numerous flowers, which is much more common, at least in Amazonian Peru. *Aptandra caudata* is vegetatively more similar to the Brazilian type material of *A. tubicina* than to the rest of the Peruvian material. However, *A. caudata* cannot be conspecific with either variant of *A. tubicina* because of the differences in size and shape of flowers and buds and the patelliform fruiting calyx.

Aptandra caudata is the largest-flowered species in the genus and approaches *Chaunochiton* in flower size and in the almost patelliformly expanded fruiting

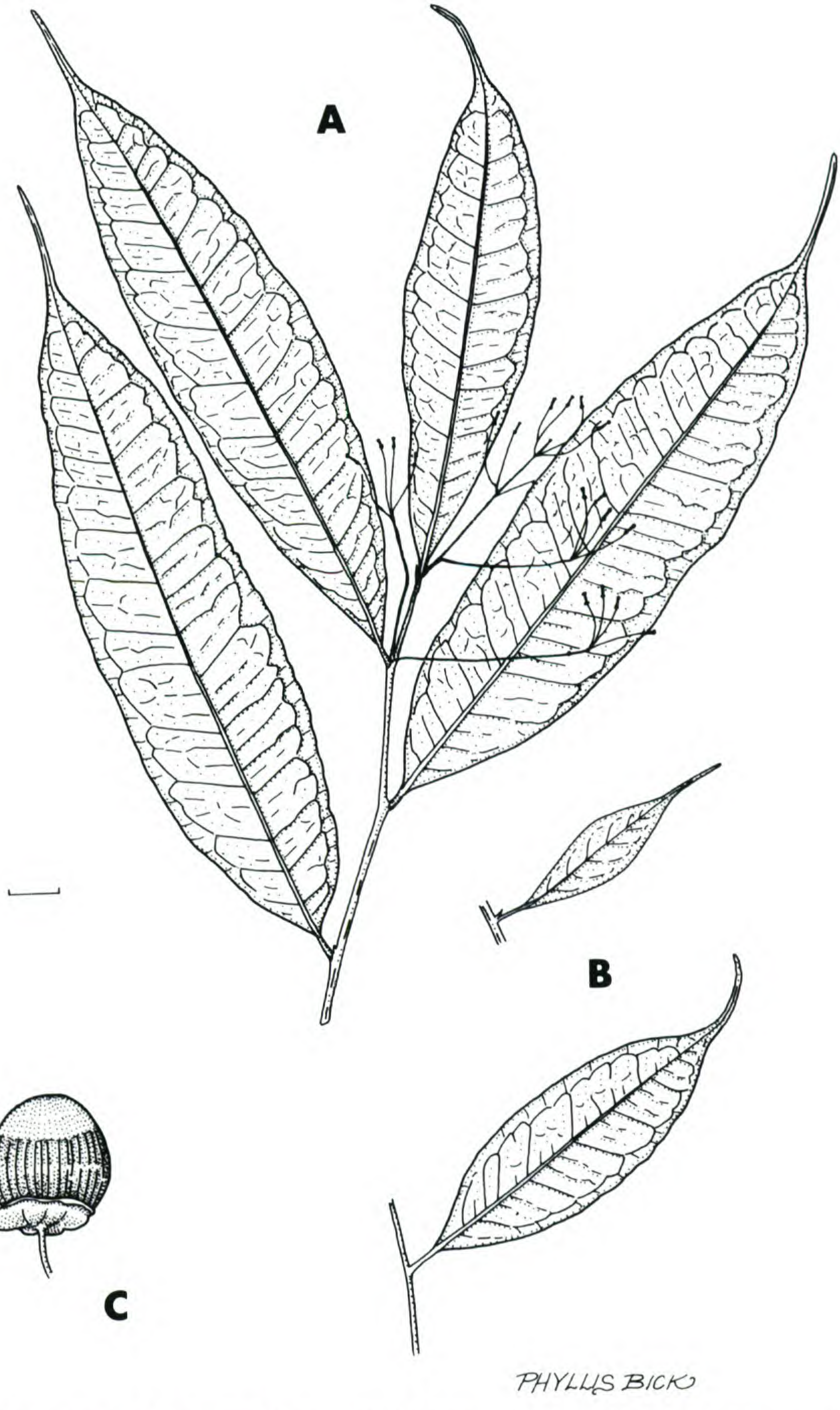

Figure 1. *Aptandra caudata* A. Gentry & Ortiz. —A. Habit (*Gentry et al. 42718*). —B. Variation in leaf size and shape (*Vasquez & Jaramillo 8156*). —C. Fruit (*Vasquez & Jaramillo 13103*). Scale bar = 1 cm.

calyx. It is locally one of the most common understory species at the type locality, with seven treelets >2.5 cm DBH in a 0.1 ha. sample.

PHYLLIS BICK

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Four New Species of *Meliosma* (Sabiaceae) from Peru

Alwyn H. Gentry
Missouri Botanical Garden, P.O. Box 299, St. Louis, Missouri 63166, U.S.A.

ABSTRACT. Four new species of *Meliosma* are described from the Peruvian Andes as *M. pumila*, *M. simiarum*, *M. sirensis*, and *M. youngii*.

Meliosma is emblematic of Peruvian cloud forest plants in its tendency to local endemism and in the incompleteness of taxonomic knowledge about it. Not a single species of Sabiaceae was known from Peru when Macbride (1956) treated related families in the *Flora of Peru*, but at least 17 *Meliosma* species (and three of lowland *Ophiocaryon*) are now known from the country (Gentry, 1986, in press). Four of the most distinctive of these are described here, all from the Peruvian Andes. These four species are all shrubs or small trees or treelets and are the smallest in stature of any neotropical *Meliosma*. Three of them are also among the smallest-leaved species of the genus; the fourth is a large-leaved pachycaul treelet.

Meliosma pumila A. Gentry, sp. nov. TYPE: Peru. Amazonas: Bongara Prov., Shillac, N of Pedro Ruiz, 5°49′S, 78°01′W, 2,300 m, moist primary montane rainforest, 31 Aug.–2 Sep. 1983 (fr), *D. Smith & S. Vasquez 4894* (holotype, MO; isotype, USM).

Frutex 0.5–2 m altus. Folia oblanceolata, 4–17 cm longa, 1–5 cm lata, acute serrata, plus minusve glabra. Inflorescentia terminalis, sparsim puberula, pedicellis 0–0.5 mm longis, sepalis 0.3–0.4 mm longis, petalis 0.7–1 mm longis. Fructus globosus, 1–1.3 cm diametro.

Shrub or treelet 0.5–2 m tall; branchlets terete, glabrous or sparsely and glabrescently pubescent with appressed trichomes when young, usually with a few small, inconspicuous lenticels. Leaves alternate, oblanceolate, 4–17 cm long, 1–5 cm wide, acuminate, cuneate at base, chartaceous, sharply serrate, the midvein strongly impressed above, raised below, secondary veins plane and inconspicuous above, raised below, each terminating in a conspicuous tooth, the tertiary venation inconspicuous and plane above, plane to subprominulous below, glabrous above, below glabrous except for a few inconspicuous appressed trichomes along main veins and sometimes very sparsely on surface; petiole 0.5–2.5 cm long. Inflorescence terminal, subpaniculate with a well-developed slender central axis and 2–4 widely separated lateral branches, sparsely puberulous, the pedicels lacking to 0.5 mm long. Flowers (seen only in bud) greenish, the sepals 5, broadly ovate, rounded, 0.3–0.4 mm long, three slightly larger than the other two, the margin minutely fimbriate; outer petals broadly ovate, ca. 1 mm long, inner petals narrow, ca. 0.7 mm long and 0.2 mm wide; fertile stamens 2, the anthers thick and suborbicular, each ca. 3 mm long, only slightly separated by the thickened connective, including connective ca. 0.6 mm across, the slender filament ca. 0.5 mm long, completely fused to the narrow inner petal; ovary ovoid, ca. 0.5 mm long. Fruit cream-colored when fresh, asymmetrically globose, ca. 1–1.3 cm diam., slightly contracted into a broad and poorly demarcated basal stipe, the surface glabrous.

Distribution. Endemic to mid-elevation cloud forests of northern Peru, south of the Huancabamba Depression, 1,850–2,300 m elevation.

Additional specimens examined. PERU. AMAZONAS: Prov. Bongara, Dist. Sipabamba, Shilla, montane forest, 1,850–1,900 m, 6 May 1981 (fr), *Young & Eisenberg 378* (MO). CAJAMARCA: Prov. Cutervo, Distr. San Andrés de Cutervo, carretera entre San Andrés y Santo Tomás, km 12, 2,320 m, 7 Aug. 1987 (fl), *Diaz & Osores 2536* (MO); lower edge of Cutervo National Park, 10–15 km N of San Andrés de Cutervo, montane cloud forest, 6°10′S, 78°40′W, 2,200–2,250 m, 11 Feb. 1988 (st), *Gentry et al. 61511* (MO, USM).

Meliosma pumila is the smallest species in the genus and can reportedly be reproductive as a 0.5-m-tall subshrub. It differs from *M. solomonii* A. Gentry, which has similarly small leaves, in the chartaceous leaf texture and consistently and sharply serrate leaf margin. It differs from *M. simiarum*, which also has small chartaceous leaves, in the cream-colored (rather than black) fruits at maturity, in the narrower leaves with conspicuously spinose serrate margins, and in the twigs and leaves either glabrous or with small appressed trichomes.

Meliosma simiarum A. Gentry, sp. nov. TYPE: Peru. San Martín: Venceremos near Amazonas border, km 291 on Rioja–Pomacocha road, 5°45′S, 77°40′W, 1,850 m, wet lower montane forest, 9 Feb. 1984 (fl, fr), *Gentry & Smith*

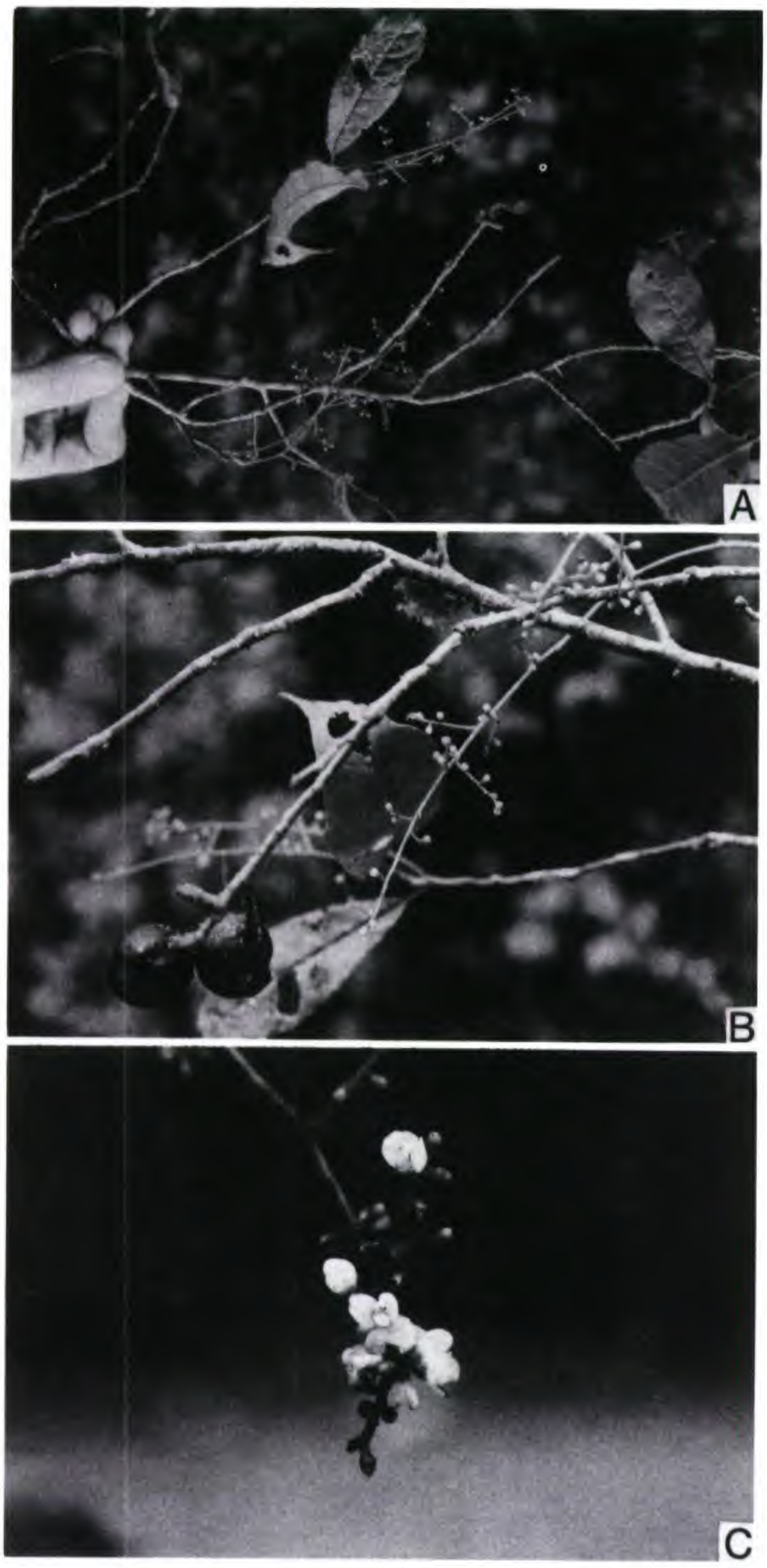

Figure 1. *Meliosma simiarum*. —A. Habit showing inflorescence, leaves, and fruit (*Gentry & Smith 45225*). —B. Close-up of inflorescence and fruit (*Gentry & Smith 45225*). —C. Close-up of flowering inflorescence (*Gentry & Smith 45335*).

45225 (holotype, MO 3517422; isotypes, MO 3517423, USM). Figure 1.

Arbor parva 6–10 m alta. Folia anguste ovata vel elliptica vel oblanceolata, 5–14 cm longa, 1.5–4.5 cm lata, puberula pro parte maxima infra in costa. Inflorescentia pauci-ramosa; plerumque axillaris, puberula, pedicellis ca. 1 mm longis, sepalis ca. 1 mm longis, petalis ca. 1 mm longis. Fructus obpyriformis, 1.4–1.7 cm longus, 1–1.5 cm diametro.

Small tree 6–10 m tall; branchlets terete, with laxly spreading reddish trichomes, lenticels large but very few and scattered. Leaves alternate, narrowly ovate to narrowly elliptic or oblanceolate, 5–14 cm long, 1.5–4.5 cm wide (–22 × 6 cm in juveniles), acuminate, cuneate to obtuse at base, chartaceous, entire or with 2–3 shallow teeth near apex at maturity, rather remotely and coarsely serrate in juveniles, the midvein impressed above, secondary veins plane above, raised below, tertiary veins plane above, finely prominulous below, puberulous with suberect trichomes along main vein below, also sparsely on secondary veins below and even more sparsely with widely scattered trichomes on surface above and below; petiole 0.3–0.7(–1) cm long, pubescent with suberect flexuous trichomes. Inflorescence a few-branched panicle, mostly axillary or borne below the leaves, with a straight rachis and 5–10 widely separated short lateral branches, pubescent with 2 kinds of trichomes, some longer and suberect, others short and gland-tipped (or the gland sessile with the stalk obsolete), the pedicels ca. 1 mm long. Flowers white, the sepals 5, broadly ovate, ca. 1 mm long, the margin erose-fimbriate, otherwise glabrous; outer petals broadly ovate, ca. 1 mm long, inner petals thinner, obtriangular, 0.5 mm long, 0.5 mm broad at apex, the filament ca. 0.8 mm long, the lower half fused to inner petal, the anthers subglobose, 0.3 mm long, widely separated by the thickened connective, sometimes only 1 developed; pistil 0.5 mm long. Fruit obpyriform 1.4–1.7 cm long, 1–1.5 cm diam., turning black at maturity, the poorly demarcated thick basal stipe having an asymmetrically squarish corner at base, glabrous, drying black.

Distribution. Endemic to lower elevation cloud forests of San Martín Department, 1,850–2,040 m elevation.

Additional specimens examined. PERU. SAN MARTÍN: type locality, 10 Feb. 1984 (st), *Gentry et al. 45318* (MO, USM), 10 Feb. 1984 (fl), *Gentry et al. 45335* (MO, USM), 12 Feb. 1984 (fl, fr), *Gentry et al. 45497* (MO, USM); Rioja Prov., Pedro Ruiz–Moyobamba road, km 390 Venceremos, 2–3 Aug. 1983 (fr), *D. Smith & S. Vasquez 4573* (MO, USM); Province of Rioja, sin. loc., *M. Leo 110* (MO).

This species is most similar to *M. pumila*, the only other species of Peruvian *Meliosma* with small noncoriaceous leaves, but differs in the more conspicuous vegetative pubescence of suberect flexuous trichomes, the entire or subentire mature leaves, the black (rather than cream-colored) fresh fruits, and the apically much broader inner petal and broader connective. Although the two species grow in the same general area, *M. pumila* occurs in the cloud forests of the Marañón Valley, while *M. simiarum* occurs on the Amazon-facing slopes.

Meliosma simiarum is named for its association with the nearly extinct yellow-tailed woolly monkey, *Lagothrix flavicaudus*, which shares the same cloud forest habitat. It is known only from the Venceremos forest, one of the last habitats of that threatened primate, where it is one of the most common understory species, averaging 40 plants >2.5 cm DBH/ha.

Meliosma sirensis A. Gentry, sp. nov. TYPE: Peru. Huánuco: Prov. Pachitea, Serranía de Siri, 26–28 km ESE of Puerto Inca, 1,750 m, elfin forest, 9°25′S, 74°43′W, 23 July 1988 (fl), *B. Wallnoffer 11-23788* (holotype, MO; isotypes, USM, W).

Arbor parva 7 m alta. Folia anguste elliptica, 5–9.5 cm longa, 1.1–2.5 cm lata, plus minusve glabra. Inflorescentia axillaris vel subterminalis, glabra, pedicellis 2–3 mm longis, sepalis ca. 1 mm longis, petalis exterioribus 2 mm longis. Fructus ignotus.

Small tree 7 m tall and 4 cm DBH; branchlets terete, glabrous or with very few scattered trichomes, the few lenticels large and tannish. Leaves alternate, narrowly elliptic, 5–9.5 cm long, 1.1–2.5 cm wide, gradually sharply acuminate, narrowly cuneate at base, coriaceous, entire, the midvein impressed above, strongly raised below, the secondary veins 6–8 on a side, brochidodromous, making nearly a 90° angle with midvein, plane and inconspicuous above, prominulous below, the tertiary venation finely and intricately prominulous-reticulate above and below, glabrous except for very few small appressed trichomes widely scattered along midvein below, both surfaces minutely lepidote-glandular, drying dark brown above, gray-brown below with contrasting brown midrib and whitish finer venation; petiole 0.6–1.4 cm long, glabrous. Inflorescence axillary or leaf-opposed to subterminal, paniculate with a well-developed central rachis, glabrous, the pedicels 2–3 mm long. Flowers white, the sepals broadly and obtusely ovate, ca. 1 mm long, with a few short, gland-tipped trichomes along margin, otherwise glabrous; outer petals broadly ovate, 2 mm long, inner petals rectangular, 1 mm long, 0.5 mm wide, not bifid, fused only at base with the filament of fertile stamen; fertile stamens 2, the slender filament 1.5 mm long, apically thickened into connective, the anthers small, oblong, each ca. 0.3 mm long, held horizontally at ends of the 0.5-mm-thick connective; ovary ovoid, 1 mm long and wide, glabrous, tapering to a short narrow style. Fruit unknown.

Distribution. Known only from the type locality in elfin forest along the crest of the isolated Serranía de Siri.

This species is closest to *M. solomonii*, the only other Andean *Meliosma* with small, narrow, coriaceous leaves. *Meliosma solomonii* has mostly larger leaves with more numerous, more strongly ascending secondary veins, a larger inflorescence with sessile or subsessile flowers and scattered appressed trichomes, and larger sepals (ca. 2 mm long). That species is known only from higher altitudes (2,450–2,850 m) in the main Andean Cordillera.

Meliosma youngii A. Gentry, sp. nov. TYPE: Peru. San Martín: Prov. Mariscal Caceres, Río Abiseo National Park, 7°S, 77°W, Las Palmas, 2,350 m, 17 Aug. 1986 (fr), *Young 4070* (holotype, MO; isotype, USM not seen).

Arbor parva 3 m alta. Folia anguste obovata, ca. 21–50 cm longa, ca. 8–16 cm lata, adpresso-puberula plerumque in costis, petiolis ca. 7 cm longis. Inflorescentia folio opposita, pyramido-paniculata, puberula. Fructus globosus, 1.4–1.7 cm diametro.

Small pachycaul tree 3 m tall, branches thick and somewhat angled, glabrous or glabrate, the bark rather wrinkled, grayish, with contrasting reddish brown raised lenticels. Leaves (only 2 seen, both broken) clustered near apex (fide K. Young), alternate, narrowly obovate, ca. 21–50 cm long, ca. 8–16 cm wide, apex not seen, base obtusely asymmetrically cuneate, membranaceous to chartaceous, apparently entire (badly eaten), the midvein impressed above, secondary veins plane above, prominent below, tertiary venation plane and not apparent above, prominulous below, appressed-puberulous along main veins above and below and sparsely over surface below; petiole ca. 7 cm long, tannish from the dense parallel-appressed short trichomes. Inflorescence (seen only in fruit) leaf-opposed, pyramidal-paniculate with a well-developed central rachis, ca. 14–24 cm long, puberulous. Flowers not seen. Fruits brownish when fresh, drying black, globose, essentially estipitate, 1.4–1.7 cm diam.

Distribution. Known only from the type specimen from montane rainforest in Río Abiseo National Park at 2,350 m.

Although the type collection has only two leaves, which are not in very good condition, there is no doubt that this represents an undescribed species. The species is characterized by the pachycaul treelet growth form and by the large thin-textured leaves (larger than any other high-altitude *Meliosma*) with conspicuously tannish, almost sericeous, petioles and midveins, and by the very smooth upper leaf surface.

Acknowledgments. Support for this study of Peruvian plants has been provided by a grant from

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Six New Species of Bignoniaceae from Upper Amazonia

Alwyn H. Gentry
Missouri Botanical Garden, P.O. Box 299, St. Louis, Missouri 63166, U.S.A.

ABSTRACT. Six new species of Bignoniaceae from upper Amazonia are described as *Arrabidaea affinis*, *Cuspidaria emmonsii*, *Distictis occidentalis*, *Haplolophium nunezii*, *Schlegelia cauliflora*, and *Schlegelia hirsuta*. In addition, merger of *Urbanolophium* with *Haplolophium* is proposed, necessitating the new combination *H. glaziovii*.

Names are needed for these six undescribed species of Bignoniaceae lianas from upper Amazonia for the familial treatment in *Flora de Colombia* and/or the *Catalogue of the Flowering Plants and Gymnosperms of Peru*. Four of the six are widespread, and one is documented to have ethnobotanical uses. In addition, discovery of *Haplolophium nunezii* makes unavoidable the reduction of *Urbanolophium* to *Haplolophium*, necessitating a new combination for its only species.

Arrabidaea affinis A. Gentry, sp. nov. TYPE: Ecuador. Napo: Lago Agrio, forest on banks of lake, 250 m, 0°7′N, 76°55′W, 1 Apr. 1980 (fl), *J. Brandbyge & E. Asanza 30393* (holotype, MO; isotype, AAU).

Frutex scandens, ramulis teretibus, minute puberulis, consociebus glandularum in nodis inter petioles. Folia 2–3-foliolata, interdum cirrho simplici, foliolis ellipticis vel anguste ovato-ellipticis, minute puberulis non nisi in nervis principalibus. Inflorescentia floribus in panicula terminali dispositis. Calyx campanulatus, valde bilabiatus, 5–7 mm longus, eglandulosus; corolla alba, tubulo-campanulata, extus sparsim puberula. Capsula ignota.

Liana to at least 16 cm diam., the branchlets terete, lepidote and minutely puberulous or papillose-puberulous, longitudinally striate, drying brownish with inconspicuous lenticels, lacking pseudostipules, interpetiolar glandular fields large and conspicuous, usually with notched upper margin. Leaves 3-foliolate or 2-foliolate with a simple tendril or tendril scar; leaflets elliptic to narrowly ovate-elliptic, acute to acuminate, obtuse to truncate at base, often the extreme base abruptly short-decurrent onto petiole apex, 5–17 cm long, 3.5–9.5 cm wide, chartaceous, secondary veins 4–6 on a side, rather conspicuously minutely lepidote above and below, also minutely subpuberulous on midvein above and basal main veins below, drying gray to dark brown above, olive-brown or olive-gray below with conspicuously darker main veins; petiolules 0.5–6 cm long, petiole 0.6–8 cm long, lepidote and minutely inconspicuously puberulous. Inflorescence a terminal panicle with well-developed central axis, the flowers mostly arranged in small ± flat-topped, corymbose clusters, each with 1–4-cm-long peduncle (cf. *A. florida*), tannish puberulous and lepidote, bracts and bracteoles minute or absent. Flowers with the calyx campanulate, strongly bilabiate, 5–7 mm long, 4–5 mm wide, the indument mostly of glandular-lepidote and stalked-lepidote trichomes, without plate-shaped glands; corolla white, broadly campanulate above the narrowly tubular base, 1.6–2 cm long, 0.8–1 cm wide at mouth of tube, the tube 1–1.5 cm long, the lobes ca. 0.5 cm long, rather sparsely pubescent with flexuous multicelled trichomes outside, the lobes inside puberulous mostly with stalked lepidote glands, tube inside glabrous except for short glandular trichomes at filaments' insertion; stamens didynamous, the thecae divaricate, 2 mm long, the connective slightly extended; ovary oblong, 1.5 mm long, 0.8 mm wide, drying blackish, densely lepidote; disk cylindric, 0.6 mm long, 1 mm wide. Fruit unknown.

Distribution. Andean foothill region of upper Amazonia from Colombia to Peru, mostly on rich-soil forest; 130–500 m elevation.

Additional specimens examined. COLOMBIA. META: alrededores de La Macarena, Sabanas de San Juan de Arama, Laguna de Plaza Bonita, 500 m, 22 Apr. 1957 (fl), *J. Idrobo 2606* (COL, fragment MO). ECUADOR. NAPO: 15 km W de Coca, via Los Zorros, 0°35′S, 77°2′W, 250 m, 18–20 Apr. 1985 (fl), *J. Zaruma, D. Neill, M. Baker & W. Palacios 108* (MO). PERU. LORETO: Río Corrientes at Ecuador border, between Teniente Lopez and Puesto Avanzado, 280–350 m, 4 Apr. 1977 (st), *Gentry, Revilla & Daly 19087* (AMAZ, MO); Explorama Inn, 1 km S of Indiana, 3°30′S, 73°1′W, 130 m, 18 June 1986 (st), *Gentry, Vasquez & Jaramillo 54672* (AMAZ, MO), 13 Feb. 1987 (st), *Gentry, Vasquez & Jaramillo 55764* (MO); Allpahuayo, 39 km SW of Iquitos on road to Nauta, 3°50′S, 73°25′W, 130 m, 24 Feb. 1988 (st), *Gentry, Vasquez, Blaney & Jaramillo 61884* (AMAZ, MO). PASCO: Prov. Oxapampa, Iscozacin, Río Iscozacin, 10°12′S, 75°13′W, 350 m, 11 July 1986 (st), *S. Knapp, R. Perez & O. Sharehua 7828* (MO). MADRE DE DIOS: Tambopata, alluvial soil along Río Tambopata, 12°49′S, 89°18′W, 280 m, 19 Feb. 1984 (st), *Gentry, Vasquez & Jaramillo 45698* (MO).

This nondescript species is similar to *A. florida* DC. except for the strongly bilabiate calyx and large and conspicuous interpetiolar glandular field. The small, white, broadly campanulate corollas are especially reminiscent of *A. florida*. The Colombian specimen was originally determined with a query as *A. florida* by Dugand and later (Dugand, 1969: 260) cited as that species. However, I think that the coincident combination of well-developed interpetiolar glandular fields and bilabiate calyces with the rich-soil ecology is adequate for specific recognition.

Cuspidaria emmonsii A. Gentry, sp. nov. TYPE: Peru. Ucayali: Provincia Coronel Portillo, Bosque von Humboldt, km 86, Pucallpa–Tingo Maria road, alt. 270 m, 8°40′S, 75°0′W, 9 Feb. 1981 (fl), *A. Gentry, K. Young, S. Libenson, M. Olsen & T. Trucios 31126* (holotype, MO; isotypes, AMAZ, USM).

Frutex scandens, ramulis teretibus, consociebus glandularum in nodis inter petiolos. Folia 2-foliolata, interdum cirrho simplici, foliolis ovatis, infra valde puberulis. Inflorescentia floribus in panicula terminali dispositis. Calyx cupulatus, minute 5-denticulatus, 4–5 mm longus; corolla rosea, tubulo-campanulata, extus puberula. Capsula linearis, teres, valde sulcata, puberula, seminibus velutinis.

Liana, the branchlets terete, the nodes with conspicuous interpetiolar glandular fields, with tiny triangular pseudostipules. Leaves 2-foliolate, the leaflets ovate, acute to obtuse, usually apiculate or abruptly short-acuminate, rounded to truncate at base, 7–13 cm long, 4.5–10 cm wide, above sparsely puberulous mostly along main veins, below densely finely puberulous with suberect trichomes, the upper surface drying dark brown, lower surface light brown or grayish. Inflorescence corymbose-paniculate, puberulous. Flowers with the calyx cylindric-cupular, 4–5 mm long, 2–3 mm wide, minutely 5-denticulate, the teeth extended as ridges on upper part of calyx, puberulous; corolla magenta, sometimes with purple dots deep in throat and purple striations in throat, tubular-campanulate above a narrowly cylindrical base, 2–4 cm long, 0.6–1.2 cm wide at mouth of tube, the tube 1.5–3 cm long including the ca. 1-cm-long constricted basal part, the lobes 0.5–1 cm long, puberulous outside and on lobes and at level of stamen insertion inside; stamens didynamous, the anther thecae bent and reflexed sharply forward near middle, ca. 1 mm long, glabrous, the connective extremely thick, extended, minutely papillose, puberulous apically; ovary ellipsoid, densely lepidote, 2 mm long, 1 mm wide. Capsule linear, terete, with a conspicuous median furrow on each valve, 45–53 cm long, 1.8–2 cm wide, puberulous, drying grayish, with scattered raised lenticels; seeds bialate, flattened, 1.3–1.7 cm long, 5–6 cm wide, the hyaline-membranaceous wings sharply demarcated from the seed body, the seed body densely velutinous.

Distribution. Southwestern Amazonia in the seasonally dry part of the southern half of Amazonian Peru and adjacent Rondônia, 200–500 m elevation.

Additional specimens examined. PERU. MADRE DE DIOS: Cocha Cashu, Manu National Park, Río Manu, Oct. 1979 (fl), *L. Emmons s.n.* (MO), 31 Dec. 1983 (fl), *Emmons 230* (MO), 1 Jan. 1984 (fl), *Emmons 233* (MO). BRAZIL. RONDÔNIA: Municipio de Santa Barbara, Rodovia BR364, km 120, 9°10′S, 63°7′W, 10 km da Sede da Mineração, 26 May 1982 (fr), *L. Teixeira et al. 782* (MO).

This species is close to *Cuspidaria subincana* A. Gentry of central and northern Amazonia, from which it differs most strikingly in the densely velutinous rather than glabrous seed body. The fruit of *C. subincana* is also much smaller (23–28 × 1–1.3 cm) and more lenticellate. I cannot reliably differentiate the two species in flower, although the tannish pubescence of the leaflet underside of the Peruvian material, at least, is quite distinct from the whitish canescent leaf undersurface of *T. subincana*. The tannish leaf pubescence of the Peruvian collections of *C. emmonsii* is more similar to that of *C. weberbaueri* (Sprague) A. Gentry of the dry Huallaga and Chanchamayo valleys of Peru, which also has velutinous seed bodies, but that species has a much narrower white flower and distinctive grayish magenta young leaves subtending the inflorescence.

The vegetative differences between *C. emmonsii* and *C. subincana* break down in Rondônia where the *Texeira et al.* collection has the leaf undersurface densely canescent as in *C. subincana* but the strongly velutinous seed body of *C. emmonsii*. This collection differs from other material of the complex in a less strongly grooved capsule valve. A flowering collection from Rondônia (*Cordeiro 613*, not included in the description) may also be conspecific; although it has been identified as *C. subincana* on account of the densely canescent leaf undersurface, it vegetatively matches the *Texeira et al.* specimen equally well. *Cuspidaria subincana* is otherwise unknown in Rondônia. That geographically intermediate material apparently is morphologically intermediate between *C. subincana* and *C. emmonsii*, with the leaves of the former but the fruits of the latter, might be interpreted to indicate that these two taxa represent extremes of a cline if the difference between glabrous and densely velutinous seeds were not so striking.

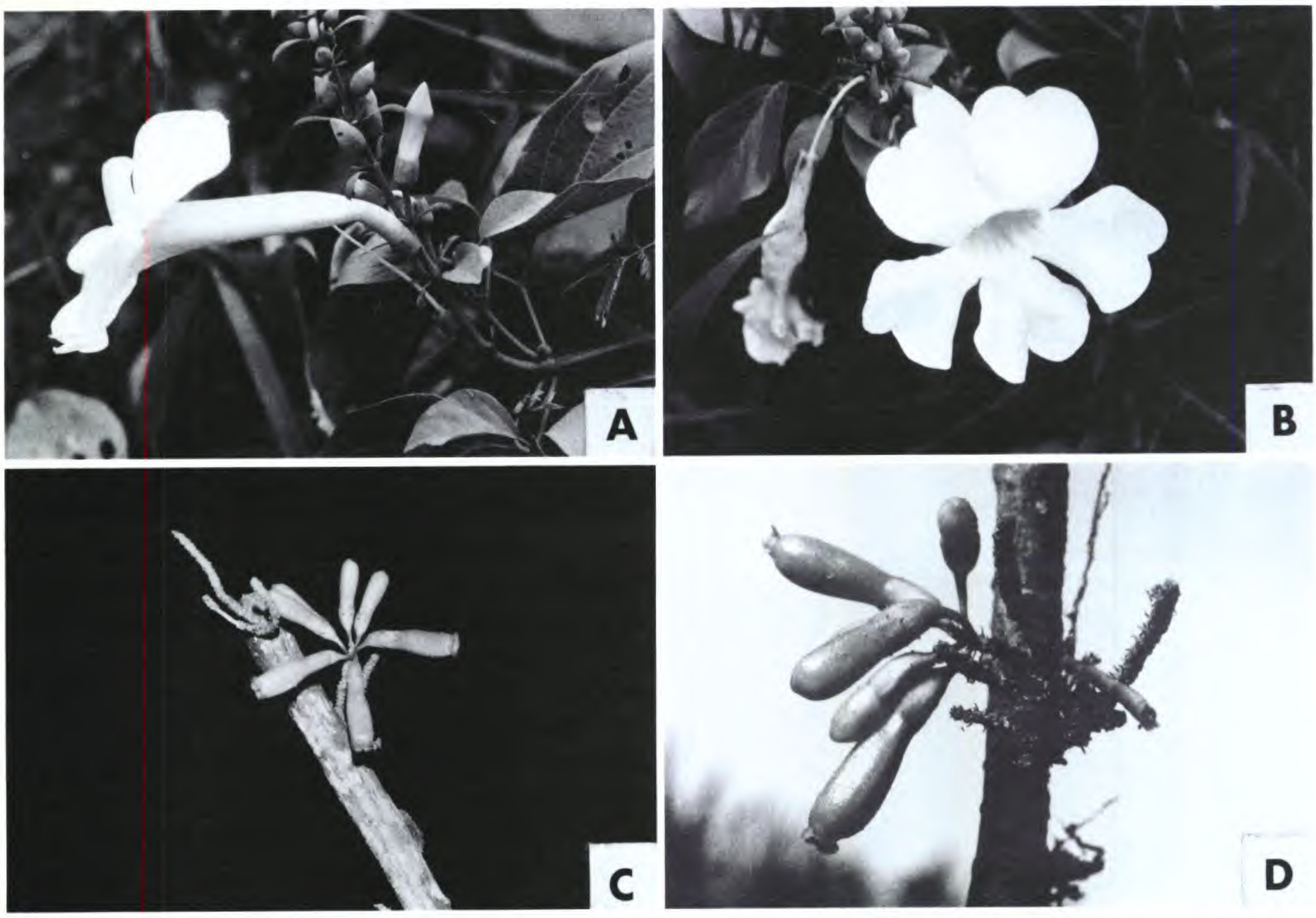

Figure 1. New species of *Distictis* and *Schlegelia*. A, B. Type of *Distictis occidentalis* (*Gentry & L. Forero 15409*). —A. Inflorescence with side view of flower. —B. Front view of corolla. C, D. *Schlegelia cauliflora*. —C. Cauliflorous inflorescence of type (*Gentry & Revilla 20656*). —D. Close-up of flowers of variant with more ventricose corolla (*Gentry 42364*).

Distictis occidentalis A. Gentry, sp. nov. TYPE: Colombia. Santander: 3 km N of Yarima on road to Albania SE of Barranca Bermeja, 25 July 1975 (fl), *Gentry & L. Forero 15409* (holotype, MO; isotype, COL). Figure 1A, B.

Frutex scandens, ramulis hexagonis, stellato-puberulis. Folia 2-foliolata, interdum cirrho trifurcato, foliolis ellipticis vel late ovatis, trichomatibus dendroideis saltem infra in nervorum secundarium axillis. Inflorescentia floribus in racemo terminali dispositis, pedicellis bracteis linearibus subtentis. Calyx cupulatus, minute 5-denticulatus, subtiliter stellato-puberulus; corolla alba, tubulo-campanulata, extus minute stellato-puberula. Capsula elliptica, dense stellato-tomentosa.

Liana, the branchlets hexagonal, the angles ribbed, sparsely lepidote and thick-stellate puberulous, drying brownish or reddish brown, the ribs usually darker, pseudostipules absent or very early caducous, when present on youngest branchlets subfoliaceous, interpetiolar glandular fields lacking. Leaves 2-foliolate, sometimes with a trifid tendril, the leaflets elliptic to broadly ovate or oblong-obovate, obtuse to short-acuminate or cuspidate, the base rounded or asymmetrically truncate (to subcordate on one side), 5–17 cm long, 3–9 cm wide, membranaceous to chartaceous, above scattered lepidote or lepidote-punctate, otherwise glabrous except for small, few-branched trichomes at base of midvein, below rather densely lepidote over surface, also puberulous with small, mostly few-branched, stellate and dendroid trichomes at least in lower vein axils and sometimes sparsely along main veins, drying brown to dark olive above, paler olive or brownish olive below; petiolules 0.8–4 cm long, petiole 1–4 cm long, minutely puberulous with a mixture of lepidote scales and simple and thick-stellate trichomes. Inflorescence a terminal raceme, the rachis stellate-puberulous, a pair of conspicuous linear bracts subtending each pair of pedicels, these 5–12 mm long and ca. 1–2 mm wide. Flowers with the calyx cupular, 5–6 mm long, 5–8 mm wide, truncate, minutely 5-denticulate, finely tannish stellate-puberulous, with conspicuous, linear, glandular fields below the margin; corolla white, tubular-campanulate above the narrow base, 5.5–9.5 cm long, 1.4–2.2 cm wide at mouth of tube, the tube 4.5–7.5 cm long, the lobes 1–2 cm long, dendroid- or stellate-pubescent outside, with linear glandular fields below the lobes,

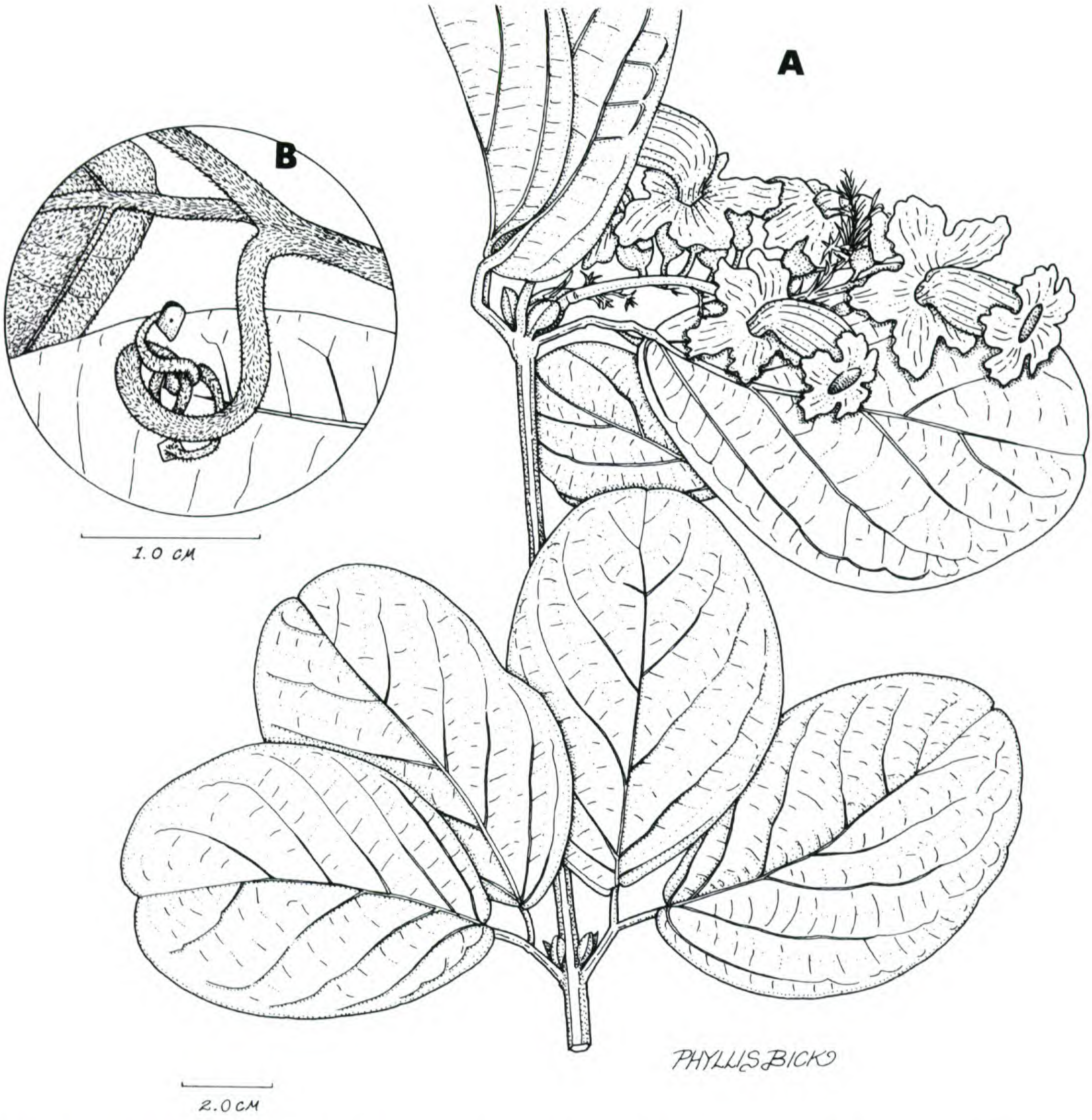

Figure 2. *Haplolophium nunezii* A. Gentry. —A. Habit (*Nuñez & Phillips 10412*). —B. Close-up of tendril.

inside glandular-lepidote and somewhat stellate, the tube inside mostly glabrous, villous with multicellular trichomes at base of stamens; stamens didynamous, the thecae divaricate, 4 mm long; ovary ellipsoidal, 3–4 mm long, 3 mm wide, densely stellate tomentose; disk annular-pulvinate, 1.5 mm long, ca. 4 mm wide. Capsule (immature) elliptic, 5 × 1.7 cm, drying dark brown, finely and densely stellate-tomentose and lepidote.

Distribution. Upper Amazonia near the base of the Andes from southern Peru to northern Ecuador, also the Magdalena Valley, and northern Choco. *Distictis occidentalis* is the westernmost South American species of the genus.

Additional specimens examined. COLOMBIA. CHOCO: hills behind Bahia Solano, 0–250 m, 5 Jan. 1973 (st), *Gentry & Forero 7241B* (COL, MO); upper Río Truando, La Teresita, 100–200 m, 19 Jan. 1974 (st), *Gentry 9361* (COL, MO); trail from Unguia to Cerro Mali, Serrania del Darien, 300–500 m, 20 Jan. 1975 (st), *Gentry & Mori 13737* (MO). Santander: road from Barranca Bermeja to El Centro, 180 m, 25 July 1975 (fl), *Gentry & Forero 15398* (COL, MO); El Centro, vic. Barranca Bermeja, 100 m, 19 July 1938 (fl), *Haught 2209* (MO). ECUADOR. NAPO: Río Cuyabeno below Laguna de Cuyabeno, 250 m, 0°3–6′S, 76°10–13′W, 14 Apr. 1980 (fl),

J. Brandbyge, E. Asanza & L. Reib 30541 (AAU, MO). PERU. MADRE DE DIOS: Lago Tres Chimbadas, 15 km NW mouth of Río La Torre, Río Tambopata, 260 m, 12°49'S, 69°17'W, 16 June 1980 (fl, fr), *Barbour 5739* (MO); tributary of Río Madre de Dios below Puerto Maldonado, 250 m, 22 Apr. 1977 (st), *Gentry et al. 19658* (MO). UCAYALI: Bosque Nacional von Humboldt, km 86 Pucallpa–Tingo Maria, 300 m, 27 Mar. 1977 (st), *Gentry et al. 18737* (AMAZ, MO).

This species is closely related to *D. granulosa* Bur. & Schumann, and most of the collections were originally referred to that species. These two species share such important taxonomic features as a finely tannish tomentose calyx, lack of pseudostipules, and reduced leaf and stem pubescence. *Distictis granulosa* differs in a lavender rather than white corolla, in lacking the conspicuous inflorescence bracts, and especially in the more coriaceous leaflets that are more evenly elliptic, often with a broadly cuneate base, and that dry a different grayish olive color below, typically with contrasting, darker-drying, parallel tertiary veins. As thus interpreted, *D. granulosa* occurs mostly in the Guayana area, ranging sparsely southwest to Madre de Dios, Peru. At Tambopata, Peru, the two species overlap and are clearly distinct, with white-flowered *D. occidentalis* occurring in swampy areas around lake margins and lavender-flowered *D. granulosa* occurring in sandy upland forest.

The other most closely related *Distictis* species is *D. scabriuscula* (Mart. ex DC.) A. Gentry of coastal Brazil, which differs in its larger (7–9 mm long), more coarsely stellate-puberulous calyx. Another coastal Brazilian species, *D. stipularis* (Mart. ex DC.) A. Gentry, has leaflets closely resembling *D. occidentalis* in texture and color but differs in its prominent, persistent leafy pseudostipules.

There may be yet another undescribed *Distictis* in Amazonian Peru, differing from *D. occidentalis* in that the leaflet venation is intricately prominulous below and the undersurface much more densely puberulous. Included here are *Croat 18576* (MO) from 7 km southwest of Iquitos and *Killip & Smith 29163* (collected by Dennis) (US) from Río Morona, Loreto, Peru, the latter a fruiting specimen discussed by Sandwith (1965) in his notes on *Anomoctenium* and related genera. Sandwith suggested that this probably represents a new taxon, which he refrained from describing in the absence of flowers. *Huashikat 1912* (MO) from Quebrada Caterpiza, Río Santiago, 200 m, represents buds and calyces of this same taxon, which has bracteate inflorescences like *D. occidentalis* and may be only a strikingly more pubescent form of the new species.

Haplolophium nunezii A. Gentry, sp. nov. TYPE: Peru. Madre de Dios: Tambopata Province, Cuzco Amazonica Tourist Lodge, 18 May 1989, *P. Nuñez & O. Phillips 10412* (holotype, MO; isotypes, CUZ, NY, USM). Figure 2.

Frutex scandens; ramuli subsexangulati sine consociebus glandularum in nodis inter petiolos. Folia bifoliolata, interdum cirrhis fissis vel simplicibus apicibus disciformibus, foliolis ellipticis, coriaceis, subtus stellato-puberulis. Inflorescentia floribus in racemo vel panicula angusta dispositis, bracteis et bracteolis linearibus; calyx cupulatus, margine expanso crispato, stellato-tomentosus; corolla alba, tubulo-campanulata, ad medium flexa; stamina didynama, thecis divaricatis; ovarium subglobosum, dense tomentosum; discus patelliformis. Capsula ignota.

Liana, the branchlets inconspicuously hexagonal, stellate-puberulous, without interpetiolar glandular fields, with obovate foliaceous pseudostipules to 1 cm long; with a dimorphic juvenile phase growing appressed to tree trunks. Leaves dimorphic, 2-foliolate, sometimes with a short trifid tendril, one or more tendril ends becoming disk-tipped, the others becoming vestigial; juvenile leaflets elliptic, 1–6 cm long, 0.6–4 cm wide, membranaceous, puberulous below with mostly simple, in part forked or stellate, trichomes mostly along main veins, petioles 0.2–0.5 cm long, the tendril apparently simple and disk-tipped, occasionally with 1–2 short, non-disk-tipped branches; mature leaflets elliptic, obtuse to rounded at base and apex, 2.5–11 cm long, 1.5–8 cm wide, coriaceous, above glabrescently puberulous with simple and forked trichomes mostly near base of midvein, below ± densely tannish puberulous with stellate trichomes, drying shiny and olive-gray above, tannish below; petiolules 0.3–1 cm long, the petiole 0.2–1.4 cm long, stellate-puberulous. Inflorescence an axillary raceme or narrow panicle with short, few-flowered lateral branches, tannish puberulous with stellate trichomes, each flower or flower cluster subtended by a pair of ca. 5-mm-long linear bracts or bracteoles, the pedicels ca. 1–2 mm long. Flowers with the calyx having a cupular base and expanded frilly margin, the base 7–10 mm long and 7–8 mm wide, the frilly membranaceous margin irregularly expanded into 5 lobes ca. 10–15 mm long, rather sparsely stellate-puberulous, also with small peltate scales; corolla white, tubular-campanulate, bent at 90° angle above base, 4–5 cm long, 1.3–1.6 cm wide at mouth of tube, the tube cylindrical and ca. 1 cm to the bend, 2.5–3 cm long above the bend, the lobes 0.6–1.0 cm long, outside puberulous with thick-stellate trichomes, also with scattered stalked-lepidote glands mostly near base of lobes, the lobes inside stellate-puberulous, tube inside mostly glabrous, glandular villous at stamen insertion; stamens

didynamous, the filaments 1.3–1.5 cm long, the anther thecae divaricate, 3 mm long, the staminode 5 mm long; pistil ca. 3 cm long, style sharply bent near middle, stellate-puberulous toward base, the ovary subglobose, 3 mm long, 3 mm wide, densely stellate-tomentose; disk patelliform, 1 mm long, 3 mm wide. Capsule unknown.

Distribution. Known only from lowland terra firme forest in southwestern Amazonia from Madre de Dios in southern Peru to Santa Cruz, Bolivia.

Additional specimens examined. PERU. MADRE DE DIOS: Cocha Cashu camp, Parque Nacional de Manu, 380 m, 17 Oct. 1979 (st), *Gentry et al. 26802* (MO, USM). BOLIVIA. SANTA CRUZ: Santa Cruz Botanical Garden, 12 km E of Santa Cruz, 17°46′S, 63°04′W, 375 m, 18 May 1991 (st), *Gentry & Limpias 74083* (LPB, MO, NY, USZ).

Haplolophium heretofore consisted of two species, *H. rodriguesii* A. Gentry, widespread in Amazonia but poorly collected, and *H. bracteatum* Cham., endemic to coastal Brazil. The fundamental characters of the genus, which belongs to subtribe Pithecocteniinae and is closely related to *Amphilophium* and *Pithecoctenium*, include 6-angled branchlets, trifid tendrils, and most notably, the unusual calyx with a cupular base and frilly expanded margin. The new species differs from *H. bracteatum* in its multiflowered inflorescence with linear bracts and bracteoles, white flowers, and densely puberulous lower leaflet surface, and from *H. rodriguesii* in the denser inflorescence and much larger calyx lobes. It differs from both species in its rounded leaflet apices, more densely pubescent leaf undersurfaces, shorter petioles and petiolules, less conspicuously 6-angled branchlets and the short disk-tipped tendril.

In the latter features, *H. nunezii* more nearly approximates *Urbanolophium*, a poorly known monotypic genus of coastal Brazil, which was separated from *Haplolophium* by Melchior (1927) on account of terete rather than hexagonal branchlets, disk-tipped tendrils, and nonechinate capsules. In fact, *H. nunezii* is more closely related to *U. glaziovii* (Bur. ex Schumann) Melch. than it is to either species of *Haplolophium* and might well be regarded as conspecific with *U. glaziovii* on vegetative grounds. The most striking difference is that *U. glaziovii* has magenta or wine-colored flowers borne in axillary clusters of (1–)2–3 rather than the well-developed inflorescence of white flowers of *H. nunezii;* the frilly calyx margin of *U. glaziovii* is also much less accentuated than in *H. nunezii*. Even though specifically distinct, *H. nunezii* and *U. glaziovii* are each other's closest relatives, and constitute another example of the remarkable disjunction between southeastern Brazil and the Bolivia–Peru border area of Amazonia (cf. Prance, 1973; see also *Clytostoma campanulatum* (Cham.) Bur. & Schumann).

The discovery of morphologically intermediate *H. nunezii* erodes the grounds for generic recognition of *Urbanolophium*, which is better considered congeneric with *Haplolophium*. Echinate and nonechinate fruits are found widely within the same genera in subtribe Pithecocteniinae (e.g., in *Pithecoctenium* (including *Neves-armondia*), *Amphilophium*, and *Haplolophium* sens. str., where *H. rodriguesii* turns out to have a nonechinate fruit). The branchlets of *U. glaziovii* are often more or less hexagonal, although less so than in related taxa; moreover, the tendril apex enlarged into an adhesive disk turns out to be of much less taxonomic significance than supposed by Melchior (1927), and is not even constant within a species. In fact, in *Pithecoctenium crucigerum* (L.) A. Gentry, development of adhesive disks at the ends of some tendril branches (but not others) is clearly no more than a phenotypic response. There is also an interesting parallel with *Mansoa*, another genus with typically branched tendrils like those of most of subtribe Pithecocteniinae. Like Pithecocteniinae, *Mansoa* has a few species that have disk-tipped tendrils, the most striking of which is *M. parvifolia* (A. Gentry) A. Gentry, anomalous in the genus in the simple tendrils, just as *H. glaziovii* and juvenile *H. nunezii* are in *Haplolophium*. The similarity is so strong that the first collection of *H. nunezii*, of a sterile juvenile plant, was identified as *M. parvifolia*. Apparently, there is a correlation between single and disk-tipped tendrils in otherwise trifid-tendrillate genera.

Another close relative of *H. nunezii* is monotypic *Glaziovia*, which is vegetatively similar to both *U. glaziovii* and *H. nunezii*, especially since the former's supposedly definitive dimorphic juvenile form is now seen to be shared with *Haplolophium*. *Glaziovia* has the strongly bilabiate "pseudocleistogamous" corolla of *Amphilophium* and seems better retained as generically distinct. However, generic merging of *Urbanolophium* and *Haplolophium* seems unavoidable, necessitating the following new combination.

Haplolophium glaziovii (Bur. ex Schumann) A. Gentry, comb. nov. *Pithecoctenium glaziovii* Bur. ex Schumann, in Engler & Prantl, Nat. Pflanzenf. 4(3b): 218. 1894. *Distictis glaziovii* (Bur. ex Schumann) Bur. & Schumann,

in Mart., Fl. Bras. 8(2b): 180. 1896. *Urbanolophium glaziovii* (Bur. ex Schumann) Melchior, Feddes Repert. Beih. 46: 80. 1927. *Bothriopodium glaziovii* (Bur. & Schumann) Rizzini, Arch. Jard. Bot. Rio de Janeiro Jan. 9: 71. 1949. TYPE: Brazil. Rio de Janeiro, *Saldanha 7445* (B possibly destroyed, P).

Haplolophium dusenianum Kränzl., Feddes Repert. 17: 118. 1921. *Urbaniella duseniana* (Kränzl.) Dusen ex Melch., Feddes Repert. Beih. 46: 81. 1927. TYPE: Brazil. Paraná: *Dusen 8015* (lectotype, BM; isolectotypes, MO, S).

Bothriopodium glaziovii (Bur. & Schumann) Rizzini var. *symmetricum* J. C. Gomes, Rev. Bras. Biol. 11: 51. 1951. TYPE: Brazil. Santa Catarina: *Reitz 611* (RB).

Schlegelia cauliflora A. Gentry, sp. nov. TYPE: Peru. Loreto: forest behind Mishana, Río Nanay between Santa María and Iquitos, 150 m alt., 13 Nov. 1977, *Gentry & Revilla 20656* (holotype, MO; isotypes, AMAZ, F, NY, USM). Figure 1C, D.

Frutex scandens hemiepiphyticus, ramulis plus minusve teretis, lenticellatis. Folia elliptica vel anguste elliptica, basim rotundata vel cuneata, coriacea, glabra. Inflorescentia cauliflora, racemosa, pedicellis puberulis. Calyx cupulatus, subtruncatus, 3–5(–6) mm longus; corolla rubra, anguste tubularis, 1.8–2(–2.2) cm longa, extus glabra; stamina subexserta. Fructus ignotus.

Hemiepiphytic liana growing appressed to tree trunks, the stem without phloem arms in cross section, the branchlets terete to somewhat angulate and flattened, lenticellate when older, without interpetiolar ridges or glandular fields. Leaves opposite, elliptic to narrowly elliptic (more than twice as long as wide), rounded to apiculate at apex, rounded or cuneate at base, without a conspicuously inrolled basal auricle, 9–16(–19) cm long, 4–8(–9) cm wide, coriaceous, venation plane above, midvein prominent and secondary veins prominulous below, glabrous except for a few scattered lepidote scales, with a few large plate-shaped glands near base of midvein below and a few smaller persistent glands scattered on undersurface; petiole woody, 5–10 mm long. Inflorescence a cauliflorous cluster of several ± contracted racemes with a woody short-shoot rachis and minute inconspicuous bracts, the pedicels puberulous, 3–5 mm long. Flowers with the calyx cupular, subtruncate, 3–5(–6) mm long, 3–4(–5) mm wide, drying brown, slightly puberulous or glabrescent, with a few scattered, large, dark-drying plate-shaped glands; corolla red, narrowly tubular, sometimes slightly ventricose toward apex, 1.8–2(–2.2) cm long, 4–5 mm wide at mouth of tube, the lobes 1–2 mm long, the tube glabrous outside, inside lepidote-glandular and glandular puberulous at stamen insertion; stamens about equal, subexserted, inserted 5 mm from base of corolla, the thecae parallel, 1(–2) mm long; pistil ca. 5 mm long, the ovary ovoid, 1.5 mm long, 1.5 mm diam., glabrous; disk fused with and not clearly differentiated from base of ovary. Fruit unknown.

Distribution. Known only from northwestern Amazonia in forests on white sand; elevation below 200 m.

Additional specimens examined. COLOMBIA. AMAZONAS: Araracuara, 2 Aug. 1986 (st), *Battjes 331* (U); Río Apaporis, raudal Jirijirimo, (fl), *Schultes 13468* (COL). CAQUETA: Santa Isabel, quebrada El Chururuco, 5 Nov. 1984 (st), *La Rotta & Mirana 534* (HA). VAUPÉS: Inambu, 18 Nov. 1952 (bud), *Romero-Castaneda 3627* (COL). BRAZIL. AMAZONAS: Rio Javari behind Palmeiras Army Post, 5°8′S, 72°49′W, 31 July 1973 (fl), *Lleras et al. P16963* (MO, NY). PERU. LORETO: Mishana (type locality), 14 July 1977 (fl), *Solomon 3620* (MO); Mishuyacu, 100 m, Oct.–Nov. 1929 (fl), *Klug 466* (US); SW of Iquitos at Peña Negra, 600 ft., 21 Nov. 1975 (fl), *C. Davidson 3657* (MO); Quistacocha, 200 m, 27 May 1978 (fl), *Gentry & Jaramillo 22312* (AMAZ, MO); Mishana, 140 m, 6 Jan. 1983 (fl), *Gentry et al. 39185* (AMAZ, MO); Río Vainilla below Río Manití, Casería Catalán, 3°35′S, 72°45′W, 29 June 1983 (fl), *Gentry 42364* (AMAZ, MO); Allpahuayo, 130 m, 35 km SW of Iquitos, 3°50′S, 73°25′W, 16 Feb. 1987 (fl), *Gentry et al. 56024* (AMAZ, MO).

Local names. "Lengua de picon" (Caqueta), "tenekoniyanejo" (Mirana).

Uses. The Mirana Indians use this plant as one of the ingredients of their curare (fide *LaRotta 534*).

This species is closely related to *S. spruceana* Schumann of the Guayana area of southern Venezuela and adjacent Brazil and Guyana, but is otherwise isolated in the genus. That species has a larger (5–7 × 4–6 mm) calyx and longer (2–2.5 cm long) corolla tube and generally larger (15–26 cm long), less coriaceous leaves with the tertiary venation typically more prominulous beneath and the leaf base with conspicuously incurved basal auricles. The inflorescence of *S. spruceana* usually has fewer flowers and is a single raceme rather than branched at the base. It is possible that the western Amazonian plant should be regarded as part of a variable *S. spruceana*, but the uniformity of the available collections and the different geographic distributions support species recognition. The new *Schlegelia* species from Amazonian Colombia here described as *S. hirsuta* is also part of this complex; it differs from *S. cauliflora* primarily in the same vegetative characters (subbullate leaves with veins hirsute below) that distinguish it from *S. spruceana* (see below).

Schlegelia hirsuta A. Gentry, sp. nov. TYPE: Colombia. Vaupés: margenes del Río en Pucarón, 240 m, 2 Oct. 1939, *Cuatrecasas 7128* (holotype, COL 35587; isotypes, COL 35589, fragment MO).

Frutex scandens (hemiepiphyticus?), ramulis subteretibus. Folia elliptica, basim rotundata sed auriculis basalibus, coriacea, plus minusve bullata, infra hirsuta. Inflorescentia cauliflora, contracto-racemosa, pedicellis puberulis. Calyx campanulatus, truncatus, 3–5 mm longus; corolla rubra, anguste tubularis, aliquantum ventricosa, 2–2.2 cm longa. Fructus ignotus.

Liana (probably hemiepiphytic; one collection indicated as treelet), branchlets subterete to irregularly subangled, glabrous, without interpetiolar ridges or glandular fields; pseudostipules apparently lacking. Leaves opposite, simple, elliptic, acute or round and shortly cuspidate apically, basally rounded except for a conspicuously auriculate 5-mm-long basal attenuation, 11–24 cm long, 4–16 cm wide, coriaceous, ± bullate, the secondary veins 6–9 on a side, impressed above and prominent below, glabrous except for a few, scattered, long trichomes above, below hirsute with 1–2-mm-long stiff trichomes along main veins and widely scattered over surface; petiole woody, 5–10 mm long to level of base of infolded auricles, an additional 5 mm between the auricles. Inflorescence a contracted raceme, borne on older stems, the branches somewhat puberulous. Flowers with the calyx campanulate, truncate, 3–5 mm long, 4–5 mm wide, slightly puberulous, corolla red, narrowly tubular, 20–22 mm long, to 5 mm wide, slightly ventricose in upper half, the lobes minute (1–1.5 mm long), minutely glandular-lepidote outside, slightly puberulous at level of stamen insertion; stamens inserted 6 mm from base of corolla tube, subexserted, the thecae parallel, 1 mm long, the longer filaments ca. 12 mm long, shorter filaments 8–9 mm long, staminode 5 mm long; pistil 3–4 mm long, the ovary spherical, 1.5 mm long, 2 mm wide, minutely lepidote, the ovules multiseriate in each locule on a single central placenta; disk indistinguishable from base of ovary. Fruit unknown.

Distribution. Known only from the Río Vaupés region of Amazonian Colombia.

Additional specimens examined. COLOMBIA. VAUPÉS: Yurupari (orilla Vaupés) 350 km arriba de Mitu, 220 m, 24 Sep. 1939 (fl), *Cuatrecasas 6994* (COL); entre el Vaupés y el Apaporis, selva del Caño Popore, afluente del Apaporis, 240 m, 30 Sep. 1939 (fl), *Cuatrecasas 7085* (COL).

Schlegelia hirsuta is closely related to *S. spruceana* Schumann of the Guayana region of Guyana, Venezuela, and Brazil. The two species share cauliflorous tubular red flowers and rather large coriaceous leaves that are usually auriculate at the base. The Colombian plants differ in the ventricose upper part of the corolla, impressed leaf venation above, hirsute midrib and secondary veins below, and shorter calyx. *Schlegelia spruceana* has an evenly tubular corolla, glabrous leaves with the main veins slightly raised or plane above, and a calyx 5–7 mm long. While these differences could prove interpretable as varietal or subspecific variation, the strikingly long trichomes along the midvein below are unique in the genus, which otherwise has glabrous or lepidote leaves, and strongly favor specific recognition.

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A New Species of *Aegiphila* (Verbenaceae) from Colombia

Ricardo M. Rueda
Departamento de Biología, Universidad Nacional Autónoma de Nicaragua, León, Nicaragua
Current address: Missouri Botanical Garden, P.O. Box 299,
St. Louis, Missouri 63166, U.S.A.

ABSTRACT. A new species, *Aegiphila narinensis* (Verbenaceae), from La Planada Reserve, Colombia, is described, and its affinities are discussed. The new species has mucronate calyx lobes, and the corolla is larger than in any other species in the genus and has a curved tube. This name is needed to complete the botanical list of plants collected at La Planada Reserve being compiled by Olga de Benavides and Alwyn Gentry.

Aegiphila is a genus of about 160 species of shrubs and trees found from Cuba and Mexico through the West Indies and Central America to Peru and northern Argentina. About 40 species are found in Colombia (Moldenke, 1980), 10 of which are endemic, including this new one.

Aegiphila narinensis Rueda, sp. nov. TYPE: Colombia. Nariño: La Planada Reserve, near Ricaurte, 1,800 m, 01°05′N, 78°01′W, 21 Dec. 1987 (fl), *Gentry, Benavides & Keating 59648* (holotype, MO; isotype, PSO not seen). Figure 1.

Suffrutex 0.5–1 m altus, glabrus. Folia petiolata; laminis subtus punctatis, ellipticis, 14–18 cm longis × 8–10 cm latis, chartaceis, 6–8 venis secundariis. Inflorescentiae 3.5–6 cm longae × 3–5 cm latae; bracteis 2–4 mm longis; pedicellis 1.5–3 cm longis. Flos lobis calycinis 1–3 mm longis mucronatis; corolla hypocrateriformi alba, glabra, tubo arcuato, 2.5–3 cm longo, lobis 1.5–2 cm longis, inaequalibus.

Subshrub 0.5–1 m tall; branches tetragonal or subterete, sparsely pilose, glabrescent. Leaves decussate-opposite; blade elliptic, acute to acuminate at apex, acute to cuneate at base, 14–18 × 8–10 cm, chartaceous, sparsely hirsute, both laminar surfaces glabrous, lower surface punctate; venation eucamptodromous to weakly brochidodromous, the midrib slightly elevated adaxially, prominently elevated abaxially, secondary veins 6–8 on each side of costa, at an angle of 45° with the costa, impressed adaxially and elevated abaxially, arcuate-ascending, with well-marked minor veins; margins entire to slightly sinuate; petioles 0.8–1 cm long. Inflorescences cymose, axillary, few-flowered, 3.5–6 × 3–5 cm; peduncles 1.5–2.5 cm long, bracts linear, 2–4 mm long; pedicels 1.5–3 mm long; peduncle, bracts, and pedicels glabrous. Calyx glabrous, the lobes triangular, mucronate, 1–3 mm long; corolla white, glabrous, salverform, the tube curved, 2.5–3 cm long, limb lobed, 1.5–2.5 cm wide, the lobes obovate, 1.5–2 cm long, unequal; stamens 4, attached to the throat of the corolla, equal, the filaments filiform, ca. 2 mm long, slightly surpassing the corolla mouth, the anthers oblong; ovary globose, the style filiform, reaching to 3–5 mm below stamen insertion, 1.5 cm long, stigma bifid, the branches 1 mm long. Fruit not seen.

Aegiphila narinensis is distinguished from other species in the genus by having mucronate calyx lobes and a curved corolla tube about 3 cm long. The corolla is larger than in any of the other species, with unequal lobes 1.5–2 cm long. This species resembles the complex of closely related and large-flowered species formed by *Aegiphila costaricensis* Mold., from Central America, and *A. haughtii* Mold., *Clerodendrum tessmanni* Mold., and *C. ulei* Hayek from South America, as discussed by Nash & Nee (1984). However, elements of this group have straight corolla tubes of less than 25 mm long, with lobes more or less equal, whereas *A. narinensis* has a curved corolla tube of more than 25 mm in length, and unequal lobes. In addition, the species of *Clerodendrum* in this group have stamens that are long exserted, whereas *A narensis* has stamens that only slightly surpass the corolla mouth.

The type was collected at 1,800 m elevation, in the cloud forest of the La Planada Reserve, in the state of Nariño, after which the species is named. This area is famous for its high biological endemism (Terborgh & Winter, 1982), to which this distinctive new species adds yet another example.

Acknowledgments. I thank John Myers for the excellent illustration, and William G. D'Arcy, Alwyn

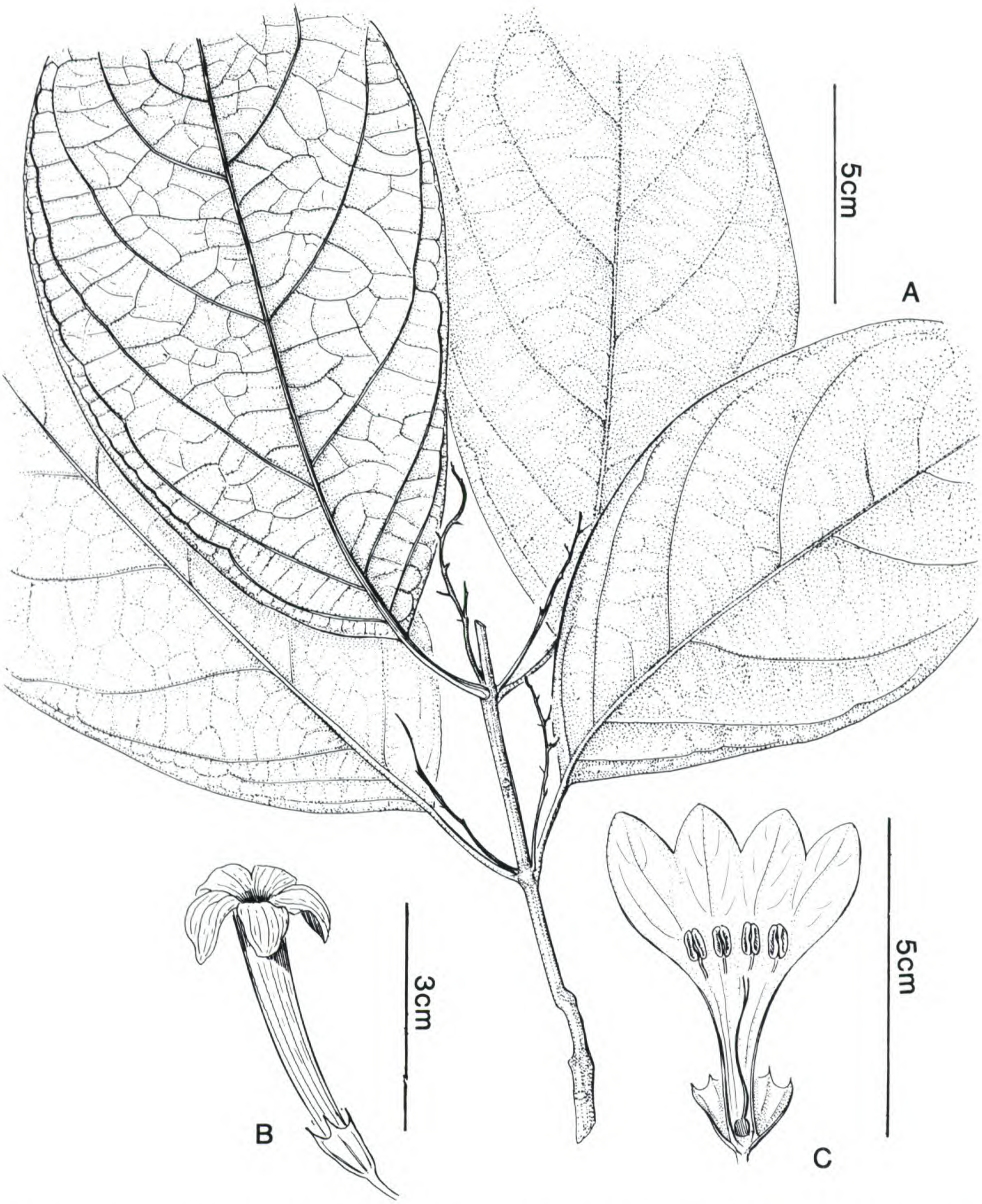

Figure 1. *Aegiphila narinensis* Rueda (*Gentry, Benavides & Keating 59648*). —A. Habit. —B. Flower. —C. Flower, partial longitudinal section.

H. Gentry, and P. Mick Richardson for comments on the manuscript.

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Mesanthophora, a New Genus of Vernonieae (Asteraceae) from Paraguay

Harold Robinson
Department of Botany, National Museum of Natural History,
Smithsonian Institution, Washington, D.C. 20560, U.S.A.

ABSTRACT. The new genus *Mesanthophora* is from a limestone area of central Paraguay. It looks similar to *Lepidaploa*, but has decurrent auriculate-based leaves, pedunculate heads from the middle of internodes, nearly equal numbers of involucral bracts and florets, and triporate, totally lophate, strongly columellate pollen lacking a perforated tectum.

A Paraguayan specimen belonging to the Asteraceous tribe Vernonieae that was sent by the Missouri Botanical Garden for identification has proven to represent a distinctive, previously undescribed genus. A superficial resemblance to *Lepidaploa* proves misleading. Both the genus and the species seem undescribed in spite of the many members of the Vernonieae that have previously been described from Paraguay by such authors as Chodat (1901–1902).

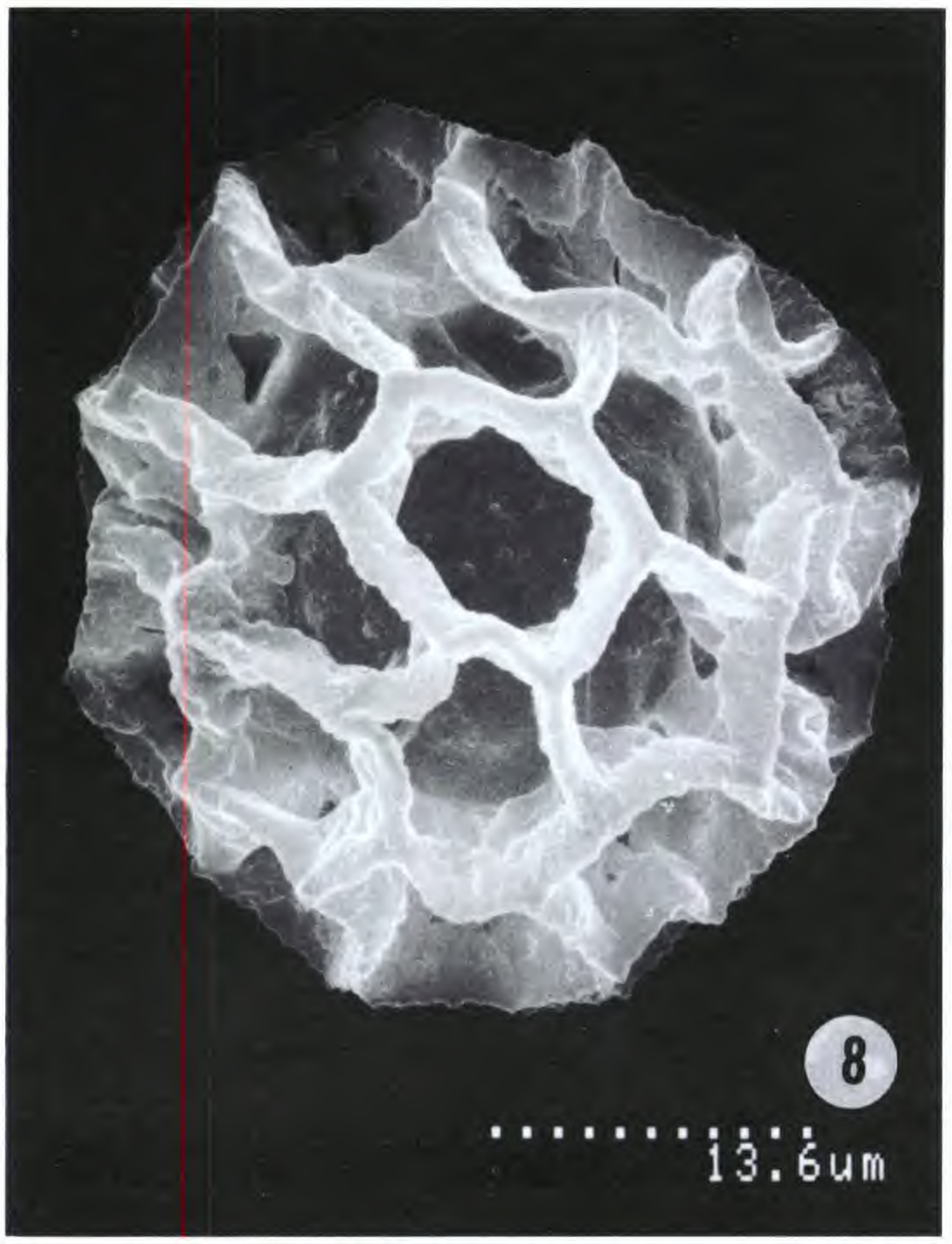
The type specimen of the new genus has a general habit of the common neotropical Vernonian genus *Lepidaploa* (Cass.) Cass. (Robinson, 1990), with series of heads among large foliose bracts along the branches of the inflorescence. However, initial observation shows that each head is pedunculate, unlike the heads of *Lepidaploa*. The new genus also differs by the position of the pedunculate heads on the middle of the internodes rather than at the nodes. The supra-axillary position seems rigorously maintained throughout the inflorescence and is a characteristic that distinguishes the plant from all other Vernonieae. In a final distinction, the leaf bases are sessile, decurrent for up to 5 mm, and are auriculate below the decurrency. The decurrency holds the basal auricles of the leaf at a downward angle compared to the rest of the leaf blade. *Lepidaploa* does not have sessile auriculate leaf bases. Other South American Vernonieae with sessile, markedly auriculate leaf bases, such as *Vernonia auriculata* Griseb., *V. jubifera* Rusby, and *V. prenanthoides* Gleason, all of Bolivia, have no decurrency, have more densely pyramidal inflorescences without large foliiform bracts, and have smaller heads bearing type A pollen (Jones, 1979).

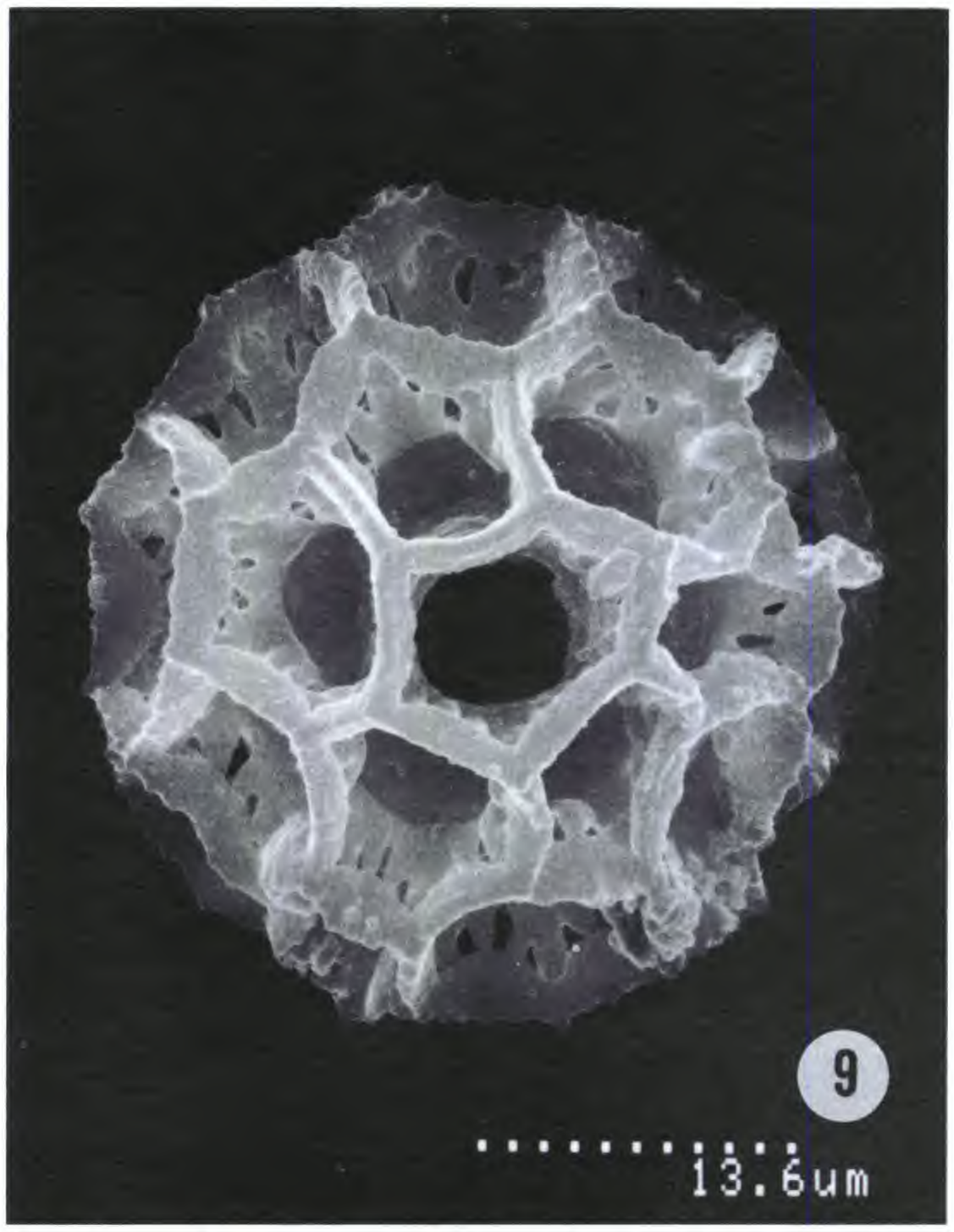
In the reproductive parts of the plant, other than pollen, it is the nature of involucral bracts that most sets the new genus apart from *Lepidaploa* and its relatives. *Mesanthophora* has nearly equal numbers of bracts and florets of the heads, which is similar to the *Vernonia* of the eastern United States. *Lepidaploa* and its close relative *Lessingianthus* H. Robinson have one and a half to three times as many bracts as florets in a head. The only examples among the *Lepidaploa* relatives that have fewer bracts than florets are some species of *Chrysolaena* H. Robinson, which have reduced numbers of both bracts and florets. The involucre of the new genus differs from those of most *Lepidaploa* because it lacks strong structural differentiation between inner and outer bracts.

The pollen of the new genus shares a lophate condition with *Lepidaploa* and its relatives, but the detailed form is totally different. The pollen lacks evident colpi and has numerous, rather uniform areoles covering the poles and sides equally. The areolation of the grains does not seem rigorously consistent in form; generally, an areole seems to be centered at each pole, surrounded by six subpolar areoles. The areoles containing the pores are sometimes directly below an areole of the subpolar series and sometimes below a wall between two subpolar areoles. Lateral areoles between the pores always seem staggered. Basal columellae are concentrated toward the junctures of the muri of the exine and often seem to radiate from the curved lower edge of the crests of the muri. The muri lack a perforated tectum of the type found in *Lepidaploa* and its relatives, and the grains lack the spines and continuous perforated tectum of the type A pollen found in *Vernonia* and many other members of the tribe.

The general pollen form with many polar areoles and no evident colpi is rare among neotropical Vernonieae, but is more common in the Paleotropics. In South America only *Acilepidopsis* H. Robinson has been found to have precisely the same type of pollen with columellae concentrated near the junctures; a relationship to paleotropical Vernonieae has been suggested for that genus (Robinson, 1989). The inflorescence of *Acilepidopsis* has sessile heads

Figures 1–7. *Mesanthophora brunneri* H. Robinson. —1. Top of plant with inflorescence. —2. Head. —3. Corolla showing tips of style and anthers. —4. Style showing basal node. —5, 6. Young achenes with part or all of inner pappus attached. —7. Older achene with inner pappus lacking.





Figures 8–11. *Mesanthophora* pollen. —8. Polar view. —9. Lateral view with pore. —10, 11. Details of exine with lintels of crests broadened in middle and columellae concentrated at corners of areoles.

containing only ca. 30 oblong, short-tipped involucral bracts and 8–13 florets, and the heads are not positioned in the middle of the internodes. As in the case of *Acilepidopsis*, the chemistry and chromosome number of the new genus, which might indicate hemispheric relationships, are not known. The neotropical aquatic *Pacourina* Aubl., which is outside of the traditional generic concept of *Vernonia* with

its large achenes and short pappus, has pollen similar to that of *Mesanthophora* and *Acilepidopsis*, and, in spite of the great difference in appearance, it could be a comparatively close relative.

The new genus is named *Mesanthophora* in reference to the position of the heads in the inflorescence at the middle of the internodes. The species is named for the collector, David R. Brunner.

Mesanthophora brunneri H. Robinson, gen. et sp. nov. TYPE: Paraguay. Concepción: Arroyo Tagatiya-mí, 22°37′S, 57°32′W, 140 m, 4 abr. 1986, *David R. Brunner 1720* (holotype, US; isotypes, MO, PY). Figures 1–11.

A *Lepidaploa foliis* base decurrentibus et auriculatis, capitulis ex mediis internodiorum pedunculatis, bracteis involucralibus et floribus ca. 100 in quoque capitulo, et granis pollinis triporatis isodiametrice multiareolatis in partibus polaribus et lateralibus tecto imperforato distincta.

Perennial herbs to 80 cm high. Stems slender, smooth, glabrous, nonfistulose. Leaves alternate, sessile, oblong-ovate, mostly 1.5–7.5 cm long, 1.0–3.2 cm wide, upper leaves smaller, base of blade bending downward and distinctly decurrent, expanded outward into broad auricles, margins subdenticulate, apex shortly acute and apiculate, surfaces glabrous, glandular-punctate below. Inflorescence narrowly thyrsoid-paniculate, with seriately cymose apex and branches, lower heads maturing first; peduncles arising from middle of internodes without closely subtending bract, 4–10 mm long, glabrous. Heads broadly campanulate; involucral bracts ca. 100, graduated in ca. 5 series, linearly lanceolate, 3–6 mm long, base to 1 mm wide, apex narrowly acute, outside glabrous. Florets 90–100; corollas bluish lavender, ca. 6.5 mm long, tube narrowly funnelform, ca. 3.5 mm long, throat ca. 1 mm long, lobes narrowly oblong, ca. 2 mm long, ca. 0.4 mm wide, with glandular dots outside more dense distally; anther thecae ca. 1.5 mm long; apical appendages oblong-ovate, ca. 0.2 mm long, glabrous, with thin-walled cells; style base with distinct narrow node. Achenes ca. 2 mm long, 8–10-costate, with many short, subappressed setulae most persistent between costae; pappus bristles white, ca. 25, ca. 3 mm long, fragile, narrowed at base, not broadened at apex, squamae of outer series ca. 2 mm long. Pollen grains ca. 55 μm diam., triporate, lophate, with numerous subisodiametric areoles in polar and lateral parts, without perforated tectum, columellae broadly attached to base, concentrated at junctures of muri, lintels of muri broadened in middle with convex lower margins.

Additional label data is, "Bosque ribereño de 20–35 m de altura cambiando a savanas y campos fuera del arroyo. Suelo calcareo de poco profundidad sobre pedra caliza." The description of the type locality is interpreted as a wooded streamside over limestone in a savanna and campo area. The collection area is on the southern edge of a large limestone and dolomite region extending northward into adjacent westernmost Mato Grosso do Sul in Brazil. The latter is an area of low hills in the Pantanal adjacent to seasonally flooded lowlands. Additional collections of the new genus and many other distinctive plants should be found in the area.

Acknowledgments. The drawings of *Mesanthophora* were prepared by Alice Tangerini of the Department of Botany, National Museum of Natural History, Smithsonian Institution. The material of the pollen was prepared by Sherry Pittam and Carol Annable of the Department of Botany, under the supervision of Joan Nowicke. The photographs were taken by Suzanne Braden of the National Museum of Natural History SEM Laboratory using a Hitachi S-570 scanning electron microscope. Prints were prepared by Victor E. Krantz, staff photographer, National Museum of Natural History.

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Recognition of *Brownea coccinea* Jacq. subspecies *capitella* (Leguminosae: Caesalpinioideae)

Dilia Velázquez
Departamento de Biología de Organismos, Universidad Simón Bolívar,
Apartado 89000, Caracas 1081, Venezuela

ABSTRACT. A new subspecies, *Brownea coccinea* subsp. *capitella*, is recognized based on geographical separation and morphological differences. A key to the subspecies is provided.

Brownea is a neotropical genus of about 12 species occurring between sea level and 1,300 m, usually in humid microenvironments. Following an initial study of the genus in Venezuela (Velásquez & Agostini, 1981), a need to revise the classification of *B. coccinea* became clear. Study of numerous specimens revealed a wide range of phenetic variation, which had previously led to descriptions of several new species, here considered as synonyms. Two groups are now being recognized, corresponding to different geographical regions in Venezuela: *B. coccinea* subsp. *coccinea*, from the western part of the Cordillera de la Costa, Zulia, and the Cordillera de los Andes; and *B. coccinea* subsp. *capitella*, occurring in the central-eastern part of the Cordillera de la Costa south to the Territorio Federal Amazonas. Subspecies *capitella* is the more common of the two, also occurring in Guyana, Trinidad-Tobago, and northern Brazil. Klitgaard (1991) reduced *Brownea angustifolia* Little to a subspecies of *B. coccinea*, but it is here considered to be a distinct species restricted to Ecuador and southwestern Colombia. Besides the geographical separation, *B. coccinea* has five equal petals, whereas *B. angustifolia* has three large, spathulate petals and two smaller, narrower ones. The two species also differ in the shape of the sepals and the form and apex of the bracteoles.

Brownea coccinea Jacq., Select. Stirp. Amer. Hist. 194, t. 121. 1763. *Hermesias coccinea* (Jacq.) Kuntze Rev. Gen. 1: 191. 1891. TYPE: tabula 121 in Jacq., Select. Stirp. Amer. Hist. 1763.

Trees 3–8 m high. Leaves petiolate; petioles 5–30 mm long; rachis 4–28 cm long; stipules deciduous; petiolules 1–4 mm long; leaflets in (4–)6 pairs, 4–20.5 × 2.2–7.2 cm, glabrous or puberulous at the base and on the costa, opposite or subopposite, elliptic, with a gland at the base; base cordate, oblique or acute; apex long acuminate; costa flat or slightly hollow at the abaxial surfaces. Inflorescence with ca. 10–30 flowers; peduncle glabrous or puberulous, 2–10 mm long; the floral rachis 2–15 cm long; bracts widely obovate, puberulous, deciduous; bractlets filiform, deciduous, 12–42 mm long; the connate bractlets glabrous or puberulous, red, 13–35 mm long, 2-lobulate, the lobule apex acute or rounded. Flowers 5–7.8 cm long; pedicel 2–18 mm long; hypanthium 6–25 mm long; sepals 4, 14–25 × 2–8 mm, red; petals 5, 22–48 × 7–19 mm, red, spathulate, the apex rounded, apiculate or retuse. Stamens 11, 33–48 mm long; the staminal sheath 14–35 mm long, irregularly connate; anthers 1.5–4 × 1–1.5 mm. Ovary 7–12 mm long, the stipe 5–17 mm long; style glabrous or puberulous at the base, 25–38 mm long. Fruit puberulous, villous or glabrate, 13–24 × 2.6–4.4 cm, the surface usually smooth and shiny when mature, the stipe 15–40 mm long, the apex acute, curved. Seeds dark brown, 20–30 × 15–20 mm.

Key to the subspecies of *Brownea coccinea*

1a. Connate bractlets longer than the hypanthium (ratio of connate bractlets : hypanthium > 1.5 : 1); ovary stipe 5–9(–11) mm long; anthers 3–4 mm long; leaflets glabrous or puberulous at the base and on the costa, the margins occasionally slightly revolute; style glabrous; inflorescences with 25–30 flowers; pedicels 2–12 mm long ..... 1. *B. coccinea* subsp. *capitella*

1b. Connate bractlets as long as or shorter than the hypanthium (connate bractlets : hypanthium ratio ca. 1 : 1); ovary stipe 14–17 mm long; anthers 1.5–3.5 mm long; leaflets glabrous, the margins usually slightly revolute; style puberulous at the base; inflorescences with 15–20 flowers; pedicels 5–17 mm long ..... 2. *B. coccinea* subsp. *coccinea*

1. Brownea coccinea Jacq. subsp. **capitella** (Jacq.) D. Velázquez & Agostini, stat. et comb. nov. *Brownea capitella* Jacq., Fragm. Bot. Illustr.: 26, t. 18, 19. 1809. *Hermesias capitella* (Jacq.) Kuntze, Rev. Gen. 1: 191. 1891. TYPE: tabulae 18, 19 in Jacq., Fragm. Bot. Illustr. 1809.

Brownea latifolia Jacq. Fragm. Bot. Illustr.: 25, t. 17. 1809. *Hermesias latifolia* (Jacq.) Kuntze, Rev. Gen. 1: 191. 1891. TYPE: tabula 17 in Jacq., Fragm. Bot. Illustr. 1809.

Brownea racemosa Jacq., Fragm. Bot. Illustr.: 25, t. 16. 1809. *Hermesias racemosa* (Jacq.) Kuntze, Rev. Gen. 1: 191. 1891. TYPE: tabula 16 in Jacq., Fragm. Bot. Illustr. 1809.

Brownea guianensis Klotzsch in R. M. Schomburgk, Reis. Br.-Guiana 3: 1209. 1848, nom. nud.

Distribution. Widely distributed through eastern, southern, and north-central Venezuela, Trinidad-Tobago, Guyana, and extreme northern Brazil, from 50 to 950 m.

Specimens examined. BRAZIL. RORAIMA: vicinity of Auaris, 4°3′N, 64°22′W, *Prance et al. 9845* (K). GUYANA. Cuyuní River, *Sandwith 626* (K); Essequibo River, Moraballi Creek, *Forest Dept. 3418* (K); Baramita, *Hardy 75* (K); Barina River, *Jenman 6933* (K); Mazaruni River, *Jenman 7621, 7595* (both K); Pomeroon District, *Im Thurn 1946* (K), *Schomburgk 90* (K); Russell District, *Jenman 2082* (K); Mazaruni River, *Hohenkok 904* (K). TOBAGO. *Eggers 5670* (GH); near Charlotesville, *F. W. H. 20106* (GH); Mason Hall area, *Howard 10468* (BM, GH). TRINIDAD. Arima Valley, near Simla, *Smith 10063* (GH); heights of Aripo, *Broadway 9794* (GH); Blanchisseuse road, *Broadway 6003* (BM, MO); near Jabaquito, *Broadway s.n.* (GH). VENEZUELA. TERRITORIO FEDERAL AMAZONAS: alrededores de San Juan de Manapiare, *Agostini 1553* (VEN); Sierra Parima, vecindades de Simarawochi, Río Matacuni, *Steyermark 107439* (MO, VEN); vecindades del Río Coro Coro y del Aeropuerto de Yutajé, *Steyermark 117903* (MO, VEN); selva de galería de El Cristo, *Williams 12565* (K); El Palmar, *Williams 12897* (K); Cacurí, 4°50′N, 65°20′W, *Lister & Colchester 2377* (K); Caño Marieta, 5°10′N, 66°30′W, *Lister & Colchester 2294* (K). ANZOÁTEGUI: La Mata de Café, NE de Bergantín, *Morillo 163* (VEN); a lo largo del río León, 500 m cerca de la Quinta Danta, *Steyermark 61007* (MO, VEN). ARAGUA: Parque Nacional Rancho Grande, *García 34* (VEN), *Lasser 2338* (VEN), *Pittier 15348* (VEN); carretera Cumboto–Turiamo, *Trujillo 5682* (MY); El Limón, *Williams 10230* (VEN). BOLÍVAR: NE de Canaima, S de Cerro Venado, *Agostini 306* (VEN); Depto. Caroní, Ciudad Guayana, Puerto Ordáz, Parque Loefling, *Agostini 2629* (VEN); Ciudad Piar, laderas no ferruginosas del Cerro Bolívar, *Aristeguieta 2206* (VEN); Puerto Ordáz, San Félix, *Aristeguieta 5303* (MO, VEN); pie de Sierra Imataca, estación Magdalena, El Palmar, *Bernardi 7051* (MER); carretera Upata–San Cayetano, Sitio Gualpa, *Cardona 2133* (VEN); Depto. Piar, La Camilera, 40 km W de El Manteco, *Delascio s.n.* (VEN); La Gran Sabana, 2 km W de Kamarata, *Koyama 7256* (VEN); 20 km E de La Paragua, *Liesner 5458* (MO, VEN); 30 km E de Upata, *Little 15926* (VEN); Alto Río Cuyuní, *Maguire 46987* (VEN); 15 km SE de El Callao, *Little 17528* (MER); Río Caura, arriba del Salto Pará, en las islas, 2–3 km del campamento Las Pavas, *Steyermark 112938* (VEN); cerca de El Palmar, *Wessels 2071* (MER); Bajo Paragua, rebalses de San Mateo, *Williams 12815* (VEN). CARABOBO: cerca de San Joaquín, *Pittier 7624* (VEN). Delta Amacuro: Depto. Tucupita, 13–14 km SE de Los Castillos, *Little 17671* (MER). DISTRITO FEDERAL: bosque alrededor de Los Caracas, *Aristeguieta 3088* (VEN); Los Caracas, *Brito 7* (VEN); Suapo, Hda. El Limón, *Gómez 43* (VEN); La Guaira, *Delgado 133* (VEN); 7 km E de Los Caracas, *Steyermark 91508* (VEN). MIRANDA: carretera Higuerote–Chuspa, 20 km NW de Higuerote, 10°35′N, 66°12′W, *Agostini 2661, 2662* (both VEN); W de Chirimena, 1 km E de la desembocadura del río Aricagua, *Berry 968* (MO, VEN); Tacarigua, *Curran 2, 4* (both MER); sendero a El Frío, Santa Lucía, *Soto 5* (VEN); Depto. Brión, NE de Pueblo Seco, 7 km E de Aricagua, *Steyermark 106914* (VEN); carretera Higuerote–Chirimena, *Velásquez 70, 94* (both VEN). MONAGAS: El Balneario, entre Las Piedras y Sabana de Las Piedras, al lado del río Guarapiche, *Badillo 7314* (MY); Chapopotal, cerca de Quiriquire, *Lasser 4096* (VEN); entre Caripito y Quiriquire, *Tamayo 3512* (VEN); entre La Pica y Caño Colorado, E de Maturín, *Wurdack 39530* (VEN). SUCRE: Cumaná, *Funck 6* (K); sabanas en cuencas del río Cariaco, *Castillo 56* (VEN); Cerro Palo de Agua, SE de El Rincón, 7 km N de El Pilar, *Morillo 3767* (VEN); alrededores de Cumanacoa, quebrada Juajuas, *Pittier 14670* (VEN); Depto. Sucre, Quebrada Zurita, Paso Hondo, S de Limonal y Santa Fé, *Steyermark 107813* (VEN); Serranía de La Paloma, entre Ajíes y Guariquén, *Steyermark 121357* (VEN); Depto. Benítez, E de Los Pozotes, entre Guaraúnos y Ajíes, *Steyermark 121271* (VEN).

2. Brownea coccinea Jacq. subsp. **coccinea.**

Brownea aroensis Pittier, Contr. U.S. Natl. Herb. 18: 152. 1916. TYPE: Venezuela. Lara: Palmasola, Aroa River, *Pittier 6367* (holotype, US not seen; photo, VEN).

Brownea guaraba Pittier, Contr. U.S. Natl. Herb. 18: 152. 1916. TYPE: Venezuela. Lara: Palmasola, Aroa River, *Pittier 6366* (holotype, US not seen; photo, VEN).

Brownea guaramaco Pittier, Cat. Flora Ven. 1: 381. 1945, nom. nud.

Brownea longiflora Pittier, Cat. Flora Ven. 1: 381. 1945, nom. nud.

Brownea superba Pittier, Cat. Flora Ven. 1: 381. 1945, nom. nud.

Distribution. Venezuela, in the western part of the Cordillera de la Costa, Cordillera de los Andes and Zulia state, from 60 to 1,300 m.

Specimens examined. VENEZUELA. FALCÓN: Depto. Silva, cerro Chichiriviche, laderas Sur, entre La Luisa y La Soledad, *Steyermark 110908* (VEN); Sierra de San Luis, entre La Negrita y La Chapa, *Steyermark 99159* (MO, VEN); lado sur del río Tocuyo, *Steyermark 94483* (VEN); Depto. Acosta, Municipio Jacura, Cerro de La Mina, *Ruíz 652* (MER); Depto. Colina, El Paramito, *Ruíz 964* (VEN); Depto. Zamora, Cerro Santa Isabel, *Ruíz 1825* (VEN); Meachiche, *Lasser 188* (VEN); Zamora, Cerro Mampostal, *González 997* (VEN); 20 km de Puerto Cumarebo, *Ewel 1* (MY); N de Sanare, *Ferrari 922* (MY); Paraguaná, 1.5 km de Pueblo Nuevo, vía a Santa Ana, *Breteler 4393* (VEN); Depto. Democracia, entre Cerro Pozo Azul y Cerro Maporal, *Agostini 1028* (VEN); Depto. Democracia, alrededor de Burnica, quebrada Araguato, *Agostini 1023* (VEN). LARA: Carretera Barquisimeto–Aroa, 15 km NW de Duaca, quebrada de Oro, *Agostini 2549* (VEN); Sicarigua, *Burkart 16627* (VEN); entre Yaritagua y Duaca,

Saer 339 (VEN). MÉRIDA: carretera Panamericana, caño Zancudo, *Bernardi 2178* (MER); El Vigia, *Little 15227* (VEN); Depto. Miranda, Municipio Palmira, Arapuey, *López-P. 3391* (MER); carretera de penetración Los Giros–Panamericana, *Quintero 1569* (MER); Río Perdido, a 7 km de la carretera Panamericana, *T. Ruíz 571* (MER); debajo Mesa Bolívar, *Steyermark 56690* (VEN). TÁCHIRA: Ureña, Aguas Calientes, *Tamayo 3692* (VEN). Trujillo: entre Agua Viva y Carora, 20 km NW de Agua Viva, *Bunting 2820* (MO, MY); cerca de El Cacao, saliendo de Cuicas, *Trujillo 1150* (MY); Sabana de Mendoza, caserío San Alejo, *Quintero 1494* (MER); entre Motatán y Agua Viva, *Tamayo 1917* (VEN). YARACUY: selvas de Yumare, *Bernardi 6938* (MER); 7 km W de Guayabo, cerca de La Carbonera, *Steyermark 94463* (VEN); San Felipe, Chiguará, *Jahn 648* (VEN); camino al Fundo El Chorro, *Aristeguieta 1236* (VEN). ZULIA: Caño María, 15 km N de El Vigía, *Breteler 4421* (MER); cerca de Mene Grande, *Pittier 10614* (VEN); selvas del Río Lora, *Pittier 10920* (VEN).

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A Further Note on *Myrsine perpauciflora* Pipoly (Myrsinaceae)

John J. Pipoly III
Missouri Botanical Garden, P.O. Box 299, St. Louis, Missouri 63166-0299, U.S.A.

ABSTRACT. *Myrsine perpauciflora* Pipoly is validated by the designation of a holotype.

Through an inadvertent error, a holotype was not designated for *Myrsine perpauciflora* Pipoly, Novon 1: 207. 1991. According to ICBN Art. 45.1, "When the various conditions for valid publication are not simultaneously fulfilled, the date [of valid publication] is that on which the last is fulfilled. . . . A name published on or after 1 Jan. 1973 for which the various conditions for valid publication are not simultaneously fulfilled is not validly published unless a full and direct reference (Art. 33.2) is given to the places where these requirements were previously fulfilled." Therefore, to fulfill the requirements of valid publication for this name, as fully and directly referenced above, I designate the holotype as follows:

Myrsine perpauciflora Pipoly, sp. nov. TYPE: Venezuela. Territorio Federal Amazonas: Cerro de la Neblina, Camp VII, 5 km NE of Pico Phelps, 00°50′40″N, 65°58′10″W, 1,850 m, 1 Feb. 1985 (fr), *M. Nee 30697* (holotype, VEN; isotypes, NY, US). Figure 3.

Acknowledgments. I thank John Pruski of NY for kindly pointing out this error, and Dan Nicolson of US for discussing the correction with me.

NOVON 2: 176. 1992.

A Further Note on *Justicia parguazensis* Wasshausen (Acanthaceae)

Dieter C. Wasshausen
Department of Botany, National Museum of Natural History, Smithsonian Institution, Washington, D.C. 20560, U.S.A.

ABSTRACT. *Justicia parguazensis* Wasshausen is the correct name in *Justicia* for *Chaetochlamys wurdackii* Leonard.

Paul Berry (MO) has pointed out that I inadvertently added an extra "a" to the new name I published for *Chaetochlamys wurdackii* Leonard in *Novon* 2: 64, 1992.

The epithet I chose is based on the name of the river known as *Rio Parguaza*, spelled incorrectly in the protologue as "Paraguaza," and the name of the species should be *Justicia parguazensis*.

I thank Paul Berry for bringing this to my attention.

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A New Species of *Solanum* Section *Micracantha* (Solanaceae) from Northeastern Brazil

Maria de Fátima Agra

Laboratório de Tecnologia Farmacêutica, Universidade Federal da Paraíba,
Caixa Postal 5009, Cidade Universitária, João Pessoa, PB, Brazil

ABSTRACT. *Solanum paraibanum* is a new species from the wet forest of northeastern Brazil; it is found only in João Pessoa, State of Paraíba. The new taxon is described and illustrated, and its closest relationships are discussed.

A distinct species of the scandent and prickly section *Micracantha* Dunal of *Solanum* L. was noted from recent collections made by the author in João Pessoa, State of Paraíba, and is described here. It is apparently rare and has been collected only three times. Its closest relationships are with a small group of species of this section restricted to the northeast of Brazil.

Solanum paraibanum Agra, sp. nov. TYPE: Brazil. Paraíba: município de João Pessoa, Cidade Universitária, 6 km Sudeste do centro, 7°06′S, 34°53′W, 30–45 m, 10 nov. 1989, *Agra 1101* (holotype, JPB; isotypes, PEUFR, MO). Figure 1.

Frutex scandens. Folia lanceolata sinuato-angulata, breviter petiolata, scabra supra strigosa, subtus pilis stellatis pulverulento-punctata. Inflorescentia scorpiodeo-cymosa, simplex, interaxillaris; pedicello 1.0–1.2 cm longo; calycis laciniis 0.8–1.0 cm longis, lineari-lanceolatis revolutis; corolla violacea, profunde lobata, extus stellato-tomentosa.

Scandent shrub 4–10 m high, with a fuscous pubescence, armed with short, yellow, recurved prickles of various sizes up to 0.4 cm. *Stem* terete, dark brown hispid-pubescent with mostly sessile pauciradiate stellae bearing greatly prolonged 3–4-celled midpoints, sparsely armed with small, broad-based, ferruginous prickles to 0.2–0.3 cm that are recurved at the apex. *Leaves* petiolate; petiole terete, to 1–3.5 cm long, stellate-scabrous, the hairs and prickles similar to those of the stems, but more compact; leaf blades chartaceous, ovate-lanceolate, the larger 8–15 cm long, 3.5–8.0 cm broad, acute at apex, broadly cuneate at base, usually sinuate-lobed, the lobes 3–4 pairs, acute, above stellate-hispid, the hairs sessile with greatly prolonged midpoints, sparsely prickly on the principal veins, beneath stellate-pubescent, the hairs sessile, porrect-stellate, 6–8-celled; sparsely armed on the midrib or minor veins, the prickles yellowish, short and recurved at apex. *Inflorescences* lateral, extra-axillary monochasial, unbranched, remote from the leaves, some of the distal flowers with reduced gynoecia; pedicels 0.6–1.0 cm long, becoming longer and stouter in fruit, stellate-pubescent and prickly with hairs similar to those of the branches and leaves and small, yellow prickles, ca. 0.1–0.15 cm at anthesis, enlarged in fruit, ca. 2–2.5 cm long, 0.3–0.5 cm wide, with small prickles and pubescence similar to those of peduncle and branches. *Flowers* heterostylous, the basal (two or more) with elongate and functional styles ca. 1.2–1.5 cm long, exceeding the anthers, broad and glabrous to a clavate stigma; the distal flowers with short thick and abortive style and stigma. *Calyx* densely stellate-pubescent, armed with short, acute, yellow prickles, deeply lobed about ¾ the length, the tube ca. 0.1 cm, the lobes linear-lanceolate and revolute. *Corolla* blue or violet, deeply parted, the lobes gradually recurved, narrowly lanceolate, 1.0–1.5 cm long, 0.3–0.4 cm wide above the tube, the tube short, 0.1–0.2 cm long, densely

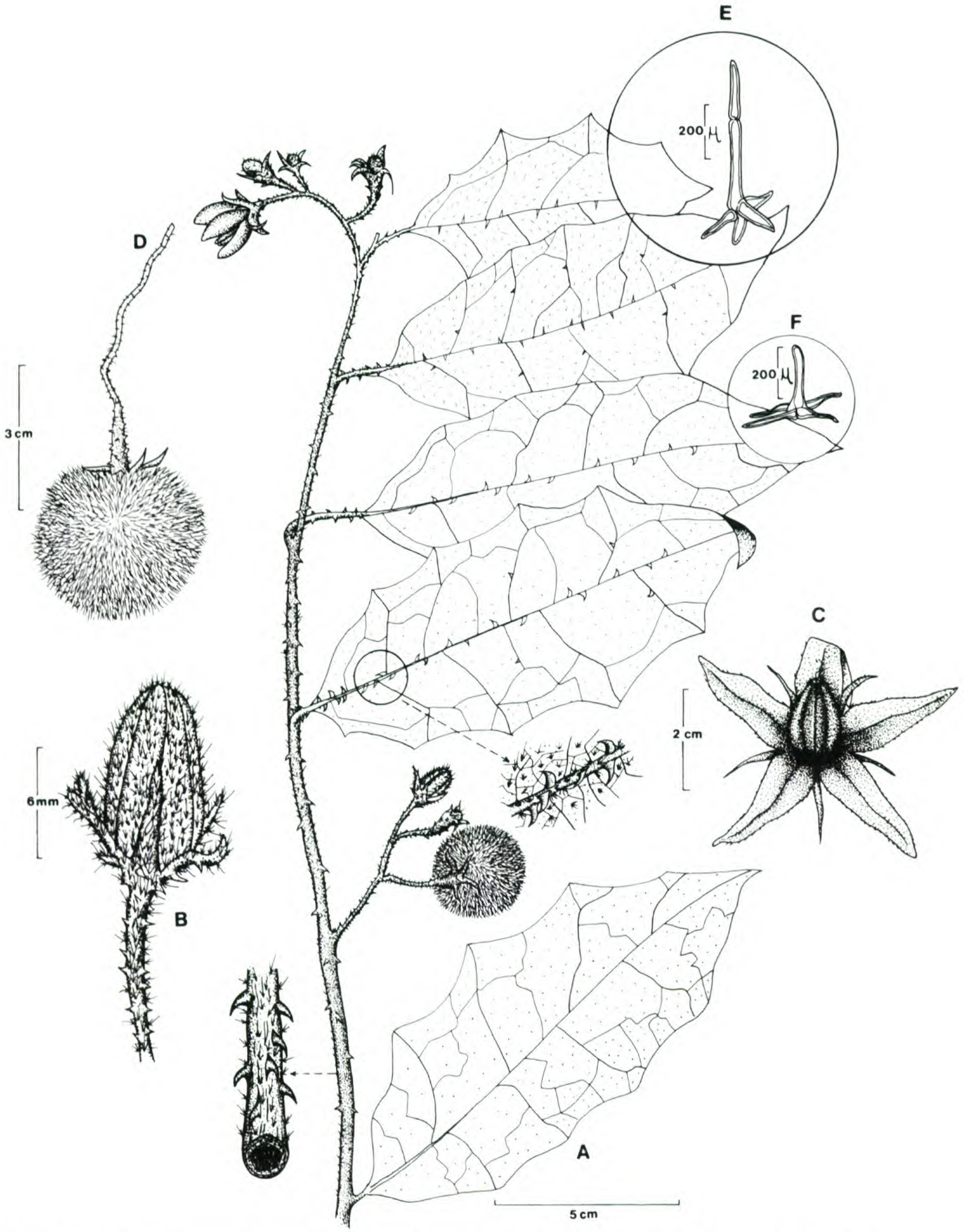

Figure 1. *Solanum paraibanum* Agra (drawing from *M. F. Agra 1101*). —A. Habit. —B. Bud. —C. Staminate flower. —D. Fruit. —E. Leaf, stellate hair, upper surface. —F. Leaf, stellate hair, lower surface.

stellate-pubescent, the hairs sessile with fully developed midpoints, sometimes with lateral rays wanting and the hairs apparently simple and stiff. *Filaments* 0.2–0.3 cm long, 0.1–0.2 cm wide, glabrous. *Anthers* equal, oblong-linear, 1.0–1.2 cm long, 0.2–0.3 cm wide at base, cordate at base, attenuate to apex, the pores minute. *Ovary* densely stellate-pubescent. *Berry* red-orange, ca. 2.5–3 cm diam.,

densely hirsute until maturity; the hairs consisting of prolonged uniseriate midpoints; seeds numerous, black, lenticular, 0.40–0.45 cm across.

Paratypes. BRAZIL. PARAIBA: João Pessoa, Campus I da Universidade Federal da Paraíba, *Moura 10* (JPB), *Agra 448* (JPB, BR).

Solanum paraibanum is known only from the type locality, in the Atlantic Coastal Forest in Paraíba, in wet forest, at elevations near sea level. This vegetation includes floristic elements related to the Amazon forest and consists mainly of tall trees, many of large diameter. The rainfall of this area is strongly seasonal, with most rains falling between May and October; it is only during these months that *S. paraibanum* flowers.

Solanum paraibanum is related to *S. rupincola* Sendtner and *S. rupincola* var. *piauhyensis* Dunal, both members of section *Micracantha* sensu D'Arcy (1973), characterized by glabrous and pubescent berries. It is distinguished from those species by the smaller size of the calyx, corolla, and fruit, the shape of the linear-lanceolate and revolute calyx lobes, and the more scabrous pubescence. These and other unnamed species are restricted to the northeast of Brazil and constitute a small, closely related group of *Micracantha* that is characterized by large berries that are densely hirsute until maturity, bearing sessile stellate trichomes with prolonged midpoints.

Acknowledgments. I am grateful to Enrique Forero for facilities at the Missouri Botanical Garden and for reading the manuscript; Geraldo Mariz for encouragement and help with the Latin diagnosis; William G. D'Arcy for corrections to the manuscript and for many helpful suggestions; and Delby F. Medeiros, Director, Laboratório de Tecnologia Farmacêutica and Jnanabrata Bhattacharyya for enthusiasm and encouragement in the study of *Solanum*. Madson R. Sousa provided the illustration of the type. Research at MO was funded in part by the Tinker Foundation.

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A New Lowland Species of *Tropaeolum* (Tropaeolaceae) from the Venezuelan Guayana

Paul E. Berry
Missouri Botanical Garden, P.O. Box 299, St. Louis, Missouri 63166, U.S.A.

ABSTRACT. *Tropaeolum orinocense* from southern Venezuela, the first species in the genus recorded from the upper Orinoco basin, is described.

Tropaeolum is a genus of southern temperate origin, with about 90 species native to South and Central America. The tropical and subtropical species are restricted to cool, montane areas, especially in the Andes, except for a few species that enter into coastal lowland Ecuador and Peru. In the most recent monograph of the family (Sparre & Andersson, 1991), no species was reported to occur in lowland Amazonia or Guayana.

In 1951, Leon Croizat participated in the Franco-Venezuelan expedition to the headwaters of the Orinoco River and made over 1,000 plant collections. One of these, *Croizat 790*, was a *Tropaeolum* growing on the banks of the upper Orinoco at about 300 m elevation. It was reported by Holst & Todzia (1990) as *T. fintelmannii* Wagener ex Schldl., a species otherwise known from the Coastal Cordillera of Venezuela and the Andes of Colombia, Ecuador, and Peru. In 1989, as part of a Venezuelan group retracing the previous expedition to the Orinoco headwaters, I found the same *Tropaeolum* at a single locality along the Orinoco above the mouth of the Río Ugueto, probably at the same site where Croizat collected it previously. Study of pickled flowers and additional dried specimens showed significant differences from *T. fintelmannii* and other related species of *Tropaeolum*. Consequently, the Orinoco collections are described as a new species and the only one known from Amazonian South America.

Tropaeolum orinocense P. Berry, sp. nov. TYPE: Venezuela. Territorio Federal Amazonas: Río Orinoco below Raudal and Salto El Tobogán, above the mouth of Río Ugueto, 2°14′N, 63°45′W, elevation 370 m, 21 Nov. 1989, *Berry 4783* (holotype, MO; isotypes, MYF, TFAV, VEN). Figure 1.

Species haec *Tropaeolo repando* Heilborn affinis, sed floribus minoribus, calcari 24–27 mm longo, petiolo a basi folii 3–5 mm inserto, foliis manifeste quinquelobatis differt.

Slender climbing herb to 5 m long, stem glabrous to lightly strigillose. Leaves peltate, insertion index (ratio of the length of the longitudinal axis of the blade distal to the point of petiole insertion vs. the proximal part) 9:1, stipules lanceolate, ca. 1 mm long; petiole 5–7(–11) cm long, glabrous to strigillose, inserted 3–5 mm from base of leaf; blade thin-membranous, glabrous, light green on upper surface, glaucous on lower surface, ± depressed ovate, 3.2–5.5 cm long, 4.5–9.0 cm wide, the length:width ratio usually 2:3 or less often 1:2, truncate at the base, shallowly 5-lobed, the central 3 lobes shortly mucronate, principal ascending veins 3 from point of petiole insertion, the lateral ones dichotomously branched close to the base. Flowers orange-red, with slender, pendent pedicels 45–75 mm long. Calyx lobes elliptic, the uppermost lobe 5 × 4 mm, the lowermost one 9–10 × 5–6 mm, with a narrowly conical spur either straight or slightly downcurved in distal ½ to ⅓, the spur 24–27 mm long and 5–6 mm diam. at point of pedicel insertion. Petals ciliate-dentate at the apex, the cilia 2–2.5 mm long, the upper two petals (opposite the pedicel) cuneate, 5–6 × 3–4 mm (excluding the cilia), the lower three spathulate-unguiculate, the blade 2.5–3.5 × 3–4 mm, somewhat concave, the claw smooth and 5–6 mm long. Stamens 8, slightly uneven, filaments 4–6 mm long, anthers 2 × 1 mm. Ovary 3-angled; style 2–3 mm long, trifid at apex, one lobe longer than the other two. Mericarps 1(–3?), ca. 5 × 3 mm, brown.

Paratypes. VENEZUELA. AMAZONAS: Ugueto, upper Río Orinoco, *Croizat 790* (VEN).

Morphologically, this species strongly resembles *Tropaeolum repandum* Heilborn, a lowland species from coastal Ecuador and northern Peru. The two are very similar in the apical position of the petal cilia and in the shape of the upper and lower petals; the depressed ovate to reniform leaf shape is also common to both species. *Tropaeolum orinocense* differs, however, in its smaller flowers and the leaves with a higher petiole insertion ratio and a higher length to width ratio. Details of petal coloration, a useful character at the species and sectional level, require further observation of fresh flowers.

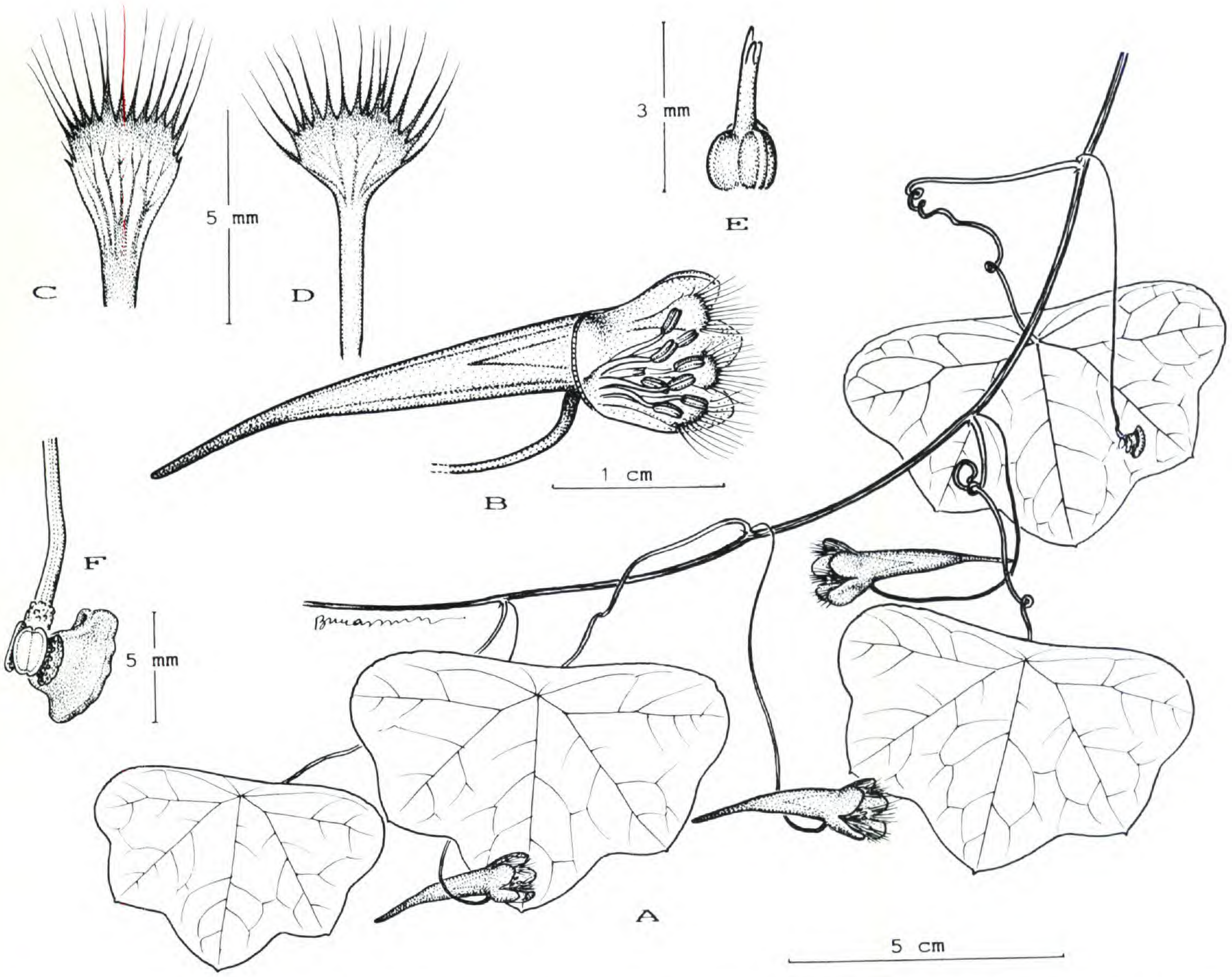

Figure 1. *Tropaeolum orinocense* P. Berry, drawn from *Berry 4783*. —A. Habit. —B. Flower, with sepals and petals partially removed to reveal the staminal arrangement. —C. Upper petal. —D. Lower petal. —E. Gynoecium at anthesis. —F. Single mericarp.

Tropaeolum orinocense is also similar in leaf shape and apically serrate-ciliate petals to *T. lasseri* Sparre, from northeastern Venezuela, and *T. emarginatum* Turcz., from northeastern Colombia. The flowers of *T. lasseri* are much smaller, however, and *T. emarginatum* has leaves with the petiole inserted much farther from the margin and petals with yellow and purple coloration.

Specimens of *Tropaeolum orinocense* were previously determined as *T. fintelmannii*, a species from northern Venezuela and Andean Colombia to Peru, but that species has a shorter calyx tube, the upper petals with fewer apical cilia, and the lower petals larger, more elliptic, and serrate-ciliate along the entire blade (not just the apex).

Sparre & Andersson (1991) established ten sections in *Tropaeolum* in their monograph of the family. They placed *T. repandum* in section *Serratociliata*, a group of mostly red-flowered species centered in the northwestern Andes, whereas *T. emarginatum*, *T. lasseri*, and *T. fintelmannii* were placed in section *Tropaeolum*, a wide-ranging group from southern Mexico to Peru. There is no clear delimitation between these two sections, however, which leaves the sectional placement of *T. orinocense* in doubt. Pollen morphology favors its placement in section *Tropaeolum*, since it has type A grains (equilateral triangle in polar view, with three identical pores), following the classification of pollen types in the family by Ricardi et al. (1957) and later modified by Huynh (1968). Type A grains occur in section *Tropaeolum*, but not in section *Serratociliata*, which has type B grains (isosceles triangle in polar view, with one smaller pore), as in *T. repandum*, or else type D grains (biaperturate and elongate).

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Nomenclatural Changes of Some Californian *Castilleja* (Scrophulariaceae)

T. I. Chuang
Department of Biological Sciences, Illinois State University, Normal, Illinois 61761, U.S.A.

L. R. Heckard†
Jepson Herbarium, University of California, Berkeley, California 94720, U.S.A.

ABSTRACT. In anticipation of the upcoming revision of the Jepson *Manual of the Flowering Plants of California*, the following 10 new nomenclatural combinations of Californian *Castilleja* subg. *Castilleja* at the subspecific level are proposed: *C. affinis* subsp. *litoralis* (Pennell) Chuang & Heckard, *C. affinis* subsp. *neglecta* (Zeile) Chuang & Heckard, *C. applegatei* subsp. *disticha* (Eastwood) Chuang & Heckard, *C. applegatei* subsp. *martinii* (Abrams) Chuang & Heckard, *C. applegatei* subsp. *pallida* (Eastwood) Chuang & Heckard, *C. applegatei* subsp. *pinetorum* (Fernald) Chuang & Heckard, *C. hispida* subsp. *brevilobata* (Piper) Chuang & Heckard, *C. lanata* subsp. *hololeuca* (Greene) Chuang & Heckard, *C. minor* subsp. *spiralis* (Jepson) Chuang & Heckard, and *C. subinclusa* subsp. *franciscana* (Pennell) Chuang & Heckard. The justification for these nomenclatural changes is briefly summarized.

The genus *Castilleja*, especially subgenus *Castilleja*, is notorious for its taxonomic difficulty, which is due at least partly to natural hybridization and associated polyploidy. We recently proposed to subdivide the expanded genus *Castilleja* into three subgenera (Chuang & Heckard, 1991): subgenus *Colacus*, with three sections, *Oncorhynchus*, *Pilosae*, and *Pallescentes*, to include bee-pollinated plants with bracts and calyx colored other than red and a relatively well-developed lower corolla lip, usually with some pouch development; subgenus *Gentrya*, a monotypic taxon from the Sierra Surutato of northern Sinaloa, Mexico, which exhibits a distinctive curved corolla and is probably also bee-pollinated; and subgenus *Castilleja*, comprising the majority of the species, which have a flower basically modified for hummingbird pollination, with bract and calyx tips predominantly red, a well-developed corolla tube, an upper lip much longer than the lower, and a lower lip reduced to three small teeth and lacking any pouch.

The purpose of this paper is to make appropriate nomenclatural changes in Californian *Castilleja* subg. *Castilleja* in anticipation of the upcoming revision of the Jepson *Manual of the Flowering Plants of California* (Jepson, 1925). The following 10 new combinations are proposed at the subspecific level. This study is based on field observations and collections of *Castilleja* in California during the past two decades and abundant herbarium specimens deposited at CAS, JEPS, and UC.

1. **Castilleja affinis** Hooker & Arnott subsp. **litoralis** (Pennell) Chuang & Heckard, comb. nov. *Castilleja litoralis* Pennell, Proc. Acad. Nat. Sci. Philadelphia 99: 183. 1947. *Castilleja wightii* Elmer subsp. *litoralis* (Pennell) Munz, Aliso 44: 98. 1958. TYPE: U.S.A. Oregon: Coos County, Bandon, 19 July 1931, *Pennell 15651* (holotype, PH).
2. **Castilleja affinis** Hooker & Arnott subsp. **neglecta** (Zeile) Chuang & Heckard, comb. et stat. nov. *Castilleja neglecta* Zeile in Jepson, Man. Fl. Pl. Calif. 936. 1925. TYPE: U.S.A. California: Marin County, Tiburon, 7 July 1907, *Brandegee s.n.* (holotype, JEPS).

Castilleja affinis is a highly intractable polyploid complex, which has six levels of polyploidy, ranging from $n = 12$ to 72 (Heckard, 1968; Chuang & Heckard, unpublished data). Pennell (1951) recognized six species in the *C. affinis* complex. These species (*C. affinis*, *C. californica* Abrams, *C. douglasii* Bentham, *C. inflata* Pennell, *C. litoralis*, and *C. neglecta*) were placed in four different sections of the genus on the basis of such morphological features as shape of leaf and calyx lobes, and the pubescence of the upper corolla lip (beak). There is too much variability and overlap in these features within the group to delimit satisfactorily distinct species. Some populations might warrant subspecific recognition but do not necessarily coincide with polyploidy levels, and various polyploidy levels intergrade to such an extent that it is impossible to make a useful taxonomic separation. Furthermore, *Cas-*

tilleja affinis itself is not sharply delimited from neighboring species, either because of its probable partial origin from them in the past or because of more recent hybridizations with them. Therefore, taxonomic recognition of any entities other than the three subspecies, subspecies *affinis*, subspecies *litoralis*, and subspecies *neglecta*, seems impractical. The taxonomic difficulties of the *C. affinis* complex are comparable to those in the Californian component of such other complex species as *Dactylis glomerata* Linn. (Stebbins & Zohary, 1959), *Ambrosia dumosa* (A. Gray ex Torr.) Payne (Raven et al., 1968), *Eriophyllum lanatum* (Pursh) Forbes (Mooring, 1975), and *Epilobium* [*Zauschneria*] *canum* (Greene) Raven (Raven, 1977).

Castilleja affinis subsp. *affinis* (n = 12, 24, 36, 48) is widespread over much of cismontane California at lower elevations in sandy and rocky soil in chaparral and coastal scrub. It is generally characterized by bristly puberulent herbage, 3- to 5-lobed leaves, acute bract and calyx lobes, and larger (25–40 mm), scarlet to orange-red flowers. A coastal-bluff form (Pt. Reyes Peninsula south to northern Santa Cruz) with rather fleshy leaves, distally inflated calyx, and less protruding corolla beak has been named *C. inflata* (= *C. wightii* subsp. *inflata* (Pennell) Munz). Another coastal sand-dune form (San Luis Obispo and Santa Barbara counties) has variable branched hairs in the herbage; this form has been named *C. affinis* var. *contentiosa* (J. F. Macbride) Bacigalupi, which perhaps represents a past introgressant between *C. affinis* and *C. mollis*. *Castilleja affinis* subsp. *litoralis* (n = 48, 60, 72) is distributed on coastal bluffs from northern California to northern Oregon. This subspecies is distinguishable by its usually glabrous herbage, entire leaves, obtuse to rounded bract and calyx lobes, and larger (25–40 mm), scarlet to orange-red flowers. *Castilleja affinis* subsp. *neglecta* (n = 36) is a rare serpentine endemic found only on Tiburon Peninsula and south of Nicasio Reservoir in Marin County and American Canyon in Solano County, and is characterized by its bristly puberulent herbage, 3- to 5-lobed leaves, acute bract and calyx lobes, and smaller (18–22 mm), yellow flowers.

3. Castilleja applegatei Fernald subsp. **disticha** (Eastwood) Chuang & Heckard, comb. et stat. nov. *Castilleja disticha* Eastwood, Proc. Calif. Acad. Sci. III. 2: 289. 1902. TYPE: U.S.A. California: Fresno County, Converse Basin, South Fork of King's River, 1–3 July 1899, *Eastwood s.n.* (holotype, CAS).

Castilleja quibellii Beane, Contr. Dudley Herb. 4: 37. 1950. TYPE: U.S.A. California: Fresno County, Rancheria Camp Ground, 11 July 1949, *Beane 1536* (holotype, DS; isotype, JEPS).

4. Castilleja applegatei Fernald subsp. **martinii** (Abrams) Chuang & Heckard, comb. et stat. nov. *Castilleja martinii* Abrams, Bull. S. Calif. Acad. Sci. 1: 69. 1902. TYPE: U.S.A. California: Los Angeles County, Wilsons Peak, San Gabriel Mountains, 10 July 1901, *Abrams 1881* (holotype, DS; isotype, DS).

Castilleja clokeyi Pennell, Proc. Acad. Nat. Sci. Philadelphia 89: 420. 1937. *Castilleja martinii* var. *clokeyi* (Pennell) N. Holmgren, Mem. New York Bot. Gard. 21: 55. 1971. TYPE: U.S.A. Nevada: Clark County, Charleston Mountains, 8 July 1936, *Clokey & Clokey 7322* (holotype, PH; isotypes, BRY, CAS, DS, MO, NY, ORE, OSC, RSA, SD, UC, US, UTC, WTU).

Castilleja roseana Eastwood, Leafl. W. Bot. 2: 104. 1938. TYPE: U.S.A. California: Monterey County, between San Lucas and Priest Valley, 11 May 1936, *Eastwood & Howell 2460* (holotype, CAS; isotypes, CAS, GH, RSA).

Castilleja hoffmannii Eastwood, Leafl. W. Bot. 3: 116. 1942. TYPE: U.S.A. California: Ventura County, between Chula Vista Camp and summit of Mount Pinos, 26 May 1928, *Howell 3840* (holotype, CAS).

Castilleja gyroloba Pennell, Proc. Acad. Nat. Sci. Philadelphia 99: 186. 1947. TYPE: U.S.A. California: Los Angeles County, near Oak Flat Camp, 18 Apr. 1940, *Pennell 25140* (holotype, PH; isotypes, DS, GH, NY, PH).

Castilleja montigena Heckard, Syst. Bot. 5: 83. 1980. TYPE: U.S.A. California: San Bernardino County, N of Baldwin Lake, San Bernardino Mountains, 12 June 1976, *Heckard & Morris 4240* (holotype, JEPS; isotypes, NY, RSA, WTU).

5. Castilleja applegatei Fernald subsp. **pallida** (Eastwood) Chuang & Heckard, comb. nov. Basionym: *Castilleja breweri* var. *pallida* Eastwood, Leafl. W. Bot. 2: 284. 1940. *Castilleja glandulifera* subsp. *pallida* (Eastwood) Pennell, in Abrams, Illust. Fl. Pac. States 3: 832. 1951. *Castilleja applegatei* var. *pallida* (Eastwood) N. Holmgren, Mem. New York Bot. Gard. 21: 37. 1971. TYPE: U.S.A. California: Alpine County, Carson Pass, 17 June 1940, *Eastwood & Howell 8449* (holotype, CAS; isotype, CAS).

Castilleja breweri Fernald, Erythea 6: 49. 1898. *Castilleja applegatei* var. *breweri* (Fernald) N. Holmgren in Cronquist et al., Intermountain Fl. 4: 486. 1984. TYPE: U.S.A. California: Tuolumne County, Mount Dana, 29 June 1863, *Brewer 1744* (holotype, GH; isotypes, UC, US).

Castilleja adenophora Eastwood, Leafl. W. Bot. 3: 87. 1941. TYPE: U.S.A. California: Inyo County, Mono Pass Trail, 22 July 1941, *Howell 16400* (holotype, CAS; isotypes, CAS, GH, PH, US).

6. Castilleja applegatei Fernald subsp. **pinetorum** (Fernald) Chuang & Heckard, comb. et stat. nov. *Castilleja pinetorum* Fernald, Erythea 6: 50. 1898. *Castilleja applegatei* var. *pinetorum* (Fernald) N. Holmgren in Cronquist et al., Intermountain Fl. 4: 486. 1984. TYPE: U.S.A. Oregon: Klamath County, Swan Lake Valley, 30 June 1896, *Applegate 415* (holotype, GH; isotypes, DS, PH).

Castilleja brooksii Eastwood, Proc. Calif. Acad. Sci. III. 2: 288. 1902. TYPE: U.S.A. California: Fresno County, Bubba Creek of King's River, 1–13 July 1899, *Eastwood s.n.* (holotype, CAS).

Castilleja trisecta Greene, Leafl. Bot. Observ. Crit. 1: 78. 1904. TYPE: U.S.A. California: Tulare County, Hockett's Meadow, 18 July 1904, *Baker 4431* (holotype, NDG; isotypes, CAS, GH, NY, RSA).

Castilleja pinetorum var. *fragilis* Zeile in Jepson, Man. Fl. Pl. Calif. 938. 1925. *Castilleja fragilis* Eastwood ex C. F. Baker, W. Amer. Pls. 3: 4. 1904, nomen nudum. *Castilleja applegatei* var. *fragilis* (Zeile) N. Holmgren, Mem. New York Bot. Gard. 21: 38. 1971. TYPE: U.S.A. California: Siskiyou County, Sisson, 14 Aug. 1903, *Copeland 3883* (holotype, CAS; isotypes, DS, GH, JEPS, MO, NY, RSA; distributed as *Castilleja fragilis*).

Castilleja excelsa Eastwood, Leafl. W. Bot. 2: 241. 1940. TYPE: U.S.A. California: Siskiyou County, near Spirit Lake, Marble Mountains, 4 Aug. 1939, *Howell 15058* (holotype, CAS).

Castilleja dolichostylis Eastwood, Leafl. W. Bot. 3: 88. 1941. TYPE: U.S.A. California: Tehama County, near Government Flat, 9 July 1941, *Eastwood & Howell 9837* (holotype, CAS; isotypes, CAS, GH, PH, US).

Castilleja wherryana Pennell, Proc. Acad. Nat. Sci. Philadelphia 99: 180. 1947. TYPE: U.S.A. Oregon: Baker County, Dooley Mountain, 4 July 1931, *Pennell 15454* (holotype, PH; isotypes, MO, NY, US).

Castilleja latifoliata Pennell ex Edwin, Leafl. W. Bot. 9: 46. 1959. TYPE: U.S.A. Nevada: Washoe County, S of Mount Ross, 24 July 1940, *Pennell 26267* (holotype, PH; isotypes, CAS, UT, UTC).

Castilleja applegatei is one of the most polytypic species of Californian *Castilleja*, but it can be distinguished from all others by its glandular-viscid herbage and usually wavy-margined leaves. Pennell (1951) recognized six species (*C. applegatei*, *C. breweri*, *C. disticha*, *C. ewanii* Eastwood, *C. gyroloba*, and *C. martinii*) in two sections of this complex, while Munz & Keck (1959) listed five (*C. applegatei*, *C. breweri*, *C. disticha*, *C. martinii*, and *C. roseana*). In his taxonomic revision of the *C. viscidula* group, Holmgren (1971) treated Californian members of the *C. applegatei* complex as comprising *C. applegatei* (with two varieties, var. *fragilis* and var. *pallida*), *C. disticha*, and *C. martinii* (with three varieties, var. *clokeyi*, var. *ewanii*, and var. *martinii*). Later, Heckard et al. (1980) added *C. montigena* from the San Bernardino Mountains of southern California, an allopolyploid (n = 24, 36) derived from diploid races (n = 12) of *C. chromosa* A. Nelson (= *C. angustifolia* (Nutt.) G. Don) and *C. martinii* var. *martinii*. The binomial *C. ewanii* has been misapplied to polyploid *C. montigena*, because the type specimen of *C. ewanii* (n = 12) falls within the diploid introgressants, and that name was consequently placed in synonymy under *C. chromosa* (Heckard et al., 1980).

A sufficient number of chromosome counts (Heckard, 1968; Chuang & Heckard, unpublished data) have been made in this group to show that considerable polyploidy (n = 12, 24, 36, 48) is present. The *C. applegatei* complex is extremely difficult taxonomically, and the complex pattern of variation has resulted in diverse treatments by earlier workers, as indicated above. The key characters used by Pennell (1951), Munz & Keck (1959), and Holmgren (1971) to identify members of this group are such differences as height of plant, degree of glandular puberulence in the herbage, leaf shape, length of corolla, and lengths of upper and lower corolla lips. In most instances, their keys allow for overlapping variation, which suggests taxonomic difficulty. It thus appears preferable to consider *C. applegatei* to be a single polytypic species. We propose the recognition of subspecies *disticha*, subspecies *martinii*, subspecies *pallida*, and subspecies *pinetorum* for the Californian members of this complex. These four subspecies can be separated imperfectly by the following key:

Key to the subspecies of *Castilleja applegatei*

1a. Leaves mostly 3-lobed; calyx 13–15 mm, divided ca. ¼ on the sides; subalpine in high Sierra Nevada ..... subsp. *pallida*

1b. Leaves mostly entire; calyx 12–22 mm, generally divided less than ⅙ on the sides (except some subsp. *pinetorum*); often below subalpine.

2a. Calyx lobes usually obtuse to rounded; central and southern California .. subsp. *martinii*

2b. Calyx lobes usually acute.

3a. Calyx 12–18 mm; central and southern Sierra Nevada ..... subsp. *disticha*

3b. Calyx 16–22 mm; widespread in northern California ... subsp. *pinetorum*

7. Castilleja hispida Bentham subsp. **brevilobata** (Piper) Chuang & Heckard, comb. et stat. nov. *Castilleja brevilobata* Piper, Proc. Biol. Sci. Wash. 33: 104. 1920. TYPE: U.S.A. Oregon: Josephine County, 8 mi. S of Waldo, 14 June 1904, *Piper 6118* (holotype, US).

According to Ownbey (1959), *Castilleja hispida* is a common, complex, and variable species most closely related to *C. angustifolia* (= *C. chromosa*). The diploid coastal plants of northern Oregon and

the tetraploid plants of the Rocky Mountains and the Cascades of Washington are strikingly similar (Heckard, 1968). This species apparently intergrades with *C. angustifolia* and *C. miniata* where their ranges juxtapose. For example, the polyploid *C. peckiana* Pennell (n = 36, 48, 60; Heckard, 1968) is in fact a morphological intermediate between *C. hispida* and *C. miniata* and was reduced to synonymy under *C. miniata* (Ownbey, 1959).

When describing *C. brevilobata*, Piper (1920) allied it with *C. angustifolia*, but noted that all its parts were smaller, its leaves were shorter-lobed, and it possessed somewhat hispidulous pubescence. Holmgren (1971) placed it in the *C. viscidula* alliance because of its glandular pubescence, its somewhat crisped-margined leaves, and its geographical location. Some specimens of *C. brevilobata* are strikingly similar in habit, leaf and bract shape, and lobing pattern to *C. hispida* of coastal central and northern Oregon and Washington, except that the former exhibits glandular puberulent herbage and has a more restricted range confined to the corner of northwestern California and southwestern Oregon. Because *C. hispida* is a highly polymorphic species and none of the criteria used to separate the two is absolute, and the variation in morphological features within each group overlaps, we prefer to treat *C. brevilobata* as a subspecies of *C. hispida*.

8. Castilleja lanata A. Gray subsp. **hololeuca** (Greene) Chuang & Heckard, comb. et stat. nov. *Castilleja hololeuca* Greene, Pittonia 1: 39. 1887. TYPE: U.S.A. California: Santa Barbara County, Island of San Miguel, Sep. 1886, *Greene s.n.* (holotype, NDG; isotype, CAS).

Castilleja lanata and *C. hololeuca*, along with *C. foliolosa* Hooker & Arnott and *C. grisea* Dunkle, have been included in section *Lanatae* because of their grayish or white tomentose herbage, branched hairs, and calyx lobes, which are rounded or wholly united laterally (Pennell, 1951). *Castilleja lanata* is widespread from northern Mexico and western Texas to southern Arizona, while *C. hololeuca* is restricted to the northern Channel Islands of California. These two taxa can be distinguished by the fact that *Castilleja hololeuca* has a smaller calyx (15–18 mm) and corolla (20–25 mm). We propose to reduce *C. hololeuca* to subspecific status under *C. lanata*. *Castilleja lanata* differs from the closely related *C. foliolosa* and *C. grisea* by its white-woolly felt of long, interwoven, slightly branched hairs, and entire leaves.

9. Castilleja minor (A. Gray) A. Gray subsp. **spiralis** (Jepson) Chuang & Heckard, comb. nov. Basionym: *Castilleja spiralis* Jepson, Fl. W. Mid. Calif. 412. 1901. *Castilleja stenantha* subsp. *spiralis* (Jepson) Munz, Aliso 4: 98. 1958. TYPE: U.S.A. California: Napa County, Butt's Canyon, 13 July 1897, *Jepson 21113* (holotype, JEPS).

Castilleja stenantha A. Gray, Syn. Fl. N. Amer. 2: 295. 1878. TYPE: U.S.A. California: *Hartweg 1897* (holotype, GH).

Castilleja minor, one of a few annual species in subgenus *Castilleja*, is widely distributed in the western United States and adjacent Mexico, growing in wet places (usually alkaline), such as marshes, streambanks, and valley hot springs. Customarily, three or four species (*C. minor*, *C. exilis* A. Nelson, *C. spiralis*, and *C. stenantha*) have been recognized in this complex. They are recognizable only by minor or very inconstant morphological features such as differences in herbage indument, length of corolla, shape of bracts, and color of lower corolla lip. Most of these characters show overlapping variation (Pennell, 1951), suggesting taxonomic difficulty. It seems preferable to treat this complex as a single variable species with two subspecies: subspecies *minor* and subspecies *spiralis*. *Castilleja minor* subsp. *minor* (including *C. exilis*) is widespread in the western United States east of the Sierra–Cascade crest and in adjacent Mexico, and is distinguished by a shorter corolla (15–20(–30) mm); in contrast, subspecies *spiralis* (including *C. stenantha*) is found only in cismontane California and has a longer corolla (25–35 cm).

10. Castilleja subinclusa Greene subsp. **franciscana** (Pennell) Chuang & Heckard, comb. et stat. nov. *Castilleja franciscana* Pennell, Proc. Acad. Nat. Sci. Philadelphia 99: 188. 1947. TYPE: U.S.A. California: San Mateo County, Crystal Springs Lake, 15 May 1940, *Pennell & Keck 25420* (holotype, PH).

Castilleja subinclusa is most closely related to *C. linariifolia* Bentham. Both species share such remarkable features as an unevenly cleft calyx and a corolla generally curved forward through a calyx sinus. The calyx divides more deeply in front (⅔) than in back (⅙–⅓), with the lobes generally curved upward. Pennell (1951) treated these two species plus *C. franciscana* Pennell in section *Linariaefoliae*. Later, Bacigalupi & Heckard (1966) described *C. jepsonii*, which is distributed in the inner South Coast Ranges from southeastern San Benito County and southward to the Sierra San Pedro Mártir in northern Baja California. They concluded that "The new species is somewhat intermediate in taxonomic

position as well as its geographic distribution between *C. affinis* and *C. linariifolia*. A hybrid origin is a possibility with the resulting hybrid derivative forming a stable self-perpetuating entity over a considerable geographic area." In that treatment, Bacigalupi & Heckard (1966) proposed to include *C. franciscana* in *C. subinclusa*. The key characters used to separate *C. subinclusa* and *C. jepsonii* comprised such variable features as color and shape of leaves, thickness of upper corolla lip, and color and shape of bract and calyx. We prefer to regard *C. subinclusa* as a highly variable species consisting of two subspecies: subspecies *subinclusa* (including *C. jepsonii*) and subspecies *franciscana*. The two subspecies can be somewhat arbitrarily distinguished by the following key.

Key to the subspecies of *Castilleja subinclusa*

1a. Corolla yellow-orange; calyx divided 2–4 mm on the sides, lobes clearly curved upward; Central and North Coast Ranges from Santa Cruz County north to Mendocino County ..... subsp. *franciscana*

1b. Corolla reddish; calyx divided 4–7 mm on the sides, lobes barely curved upward; widespread from South Coast Ranges south to northern Baja California and central and southern Sierra Nevada foothills ..... subsp. *subinclusa*

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Jaltomata grandiflora (Solanaceae): A Rare Mexican Species

William G. D'Arcy
Missouri Botanical Garden, P.O. Box 299, St. Louis, Missouri 63166, U.S.A.

Thomas Mione
University of Connecticut, Department of Ecology and Evolutionary Biology, Storrs, Connecticut 06269, U.S.A.

Tilton Davis IV
Wyoming State Crime Laboratory, 316 22nd Street, Cheyenne, Wyoming 82002, U.S.A.

ABSTRACT. *Saracha grandiflora* is transferred to *Jaltomata* as *J. grandiflora*. The species appears to be rare: only three collections are known, all from the same locality. A closely related species of *Jaltomata*, *J. procumbens*, is undergoing progressive domestication in Mexico, and this species expands the representation of the genus in the region.

The generic concepts of *Saracha* Ruíz & Pavón and *Jaltomata* Schldl. have long been confused, and although recent workers (Gentry, 1973; Davis, 1980) have clarified the separation of the two groups, some species that were described as *Saracha* remain to be transferred to *Jaltomata*. This paper makes one such transfer.

Our interest in this species stems from seed collected (*Davis 1114*) from Mexico that has been grown and propagated over several years. The earliest name we found for the species is now in *Saracha* and not in *Jaltomata*, where it should be placed. Because the species is hitherto unknown except for the brief original description, we provide an illustration and an amplified description made from our cultivated plants and the holotype.

Jaltomata grandiflora (Robinson & Greenmann) D'Arcy, Mione & Davis, comb. nov. Basionym: *Saracha grandiflora* Robinson & Greenmann, Amer. J. Sci., ser. 3. 161. 1895. TYPE: Mexico. Michoacán: hills near Patzcuaro, 22 July 1892, *Pringle 5273* (GH). Figure 1.

Sprawling perennial herb to 1 m long, the ultimate branchlets ascending, growth often plagiotropic and the stems appearing somewhat zigzagged; rootstock large (14 cm long × 3 cm wide or larger) and starchy; pubescence white, erect, simple, multicellular hairs, these sometimes exuding minute clear droplets (glandular). Stems subterete or somewhat pentagonal, drying angled, sometimes with reddish longitudinal stripes, weak, becoming stout, the pith large, becoming hollow with age, villous-velutinous with persistent, erect, weak, whitish, sometimes glandular hairs ca. 1 mm long and occasional hairs to 2 mm long. Leaves alternate along the stems or subequal-paired in the flowering regions, the nodes mostly 1–5 cm apart; lamina ovate, mostly 4–8(–12) cm long, 3–5(–8) cm wide, apically broadly acute or obtuse, basally short-cuneate and winging the distal portion of the stems, the margins entire or 2–3 sinuate-lobed on each side, softly membranous, major veins ca. 5 on each side, slightly arcuate, bifurcating near the margins into one trace leading into a lobe, and another looping and anastomosing to form a weak, undulating submarginal vein, the venation pellucid, above fine and slightly impressed, beneath thick, elevated, and conspicuously white-strigulose, villous overall with weak erect hairs, more densely so proximally and above, ciliate, slightly discolorous, slightly shiny above, drying paler beneath; petioles 1–2.5(–5) cm long, longer and sometimes reddish beneath in age, flattened above, evenly pubescent. Inflorescences racemose, arising in the axils of a pair of leaves near the branch tips; (1–)2(–3)-flowered; peduncles terete, green, evenly pubescent, ca. 8 mm long; pedicels resembling the peduncles but slightly thinner, mostly 12–15 mm long, expanded slightly upward, hardly accrescent. Flowers all perfect, buds turbinoid, becoming flat-topped, prominently 5-angled; calyx green, 10–15 mm across, membranaceous, lobed about halfway, the lobes deltoid-obtuse, soon porrect, keeled, minutely puberulent inside, villous outside; corolla rotate, yellowish white with green maculae forming a star occupying the central ¼–⅓ of the limb, pentagonal, 25 mm across, pubescent on the veins outside and near the center within, ciliate, the costae evident, fine, elevated outside, the lobes deltoid-acute; sta-

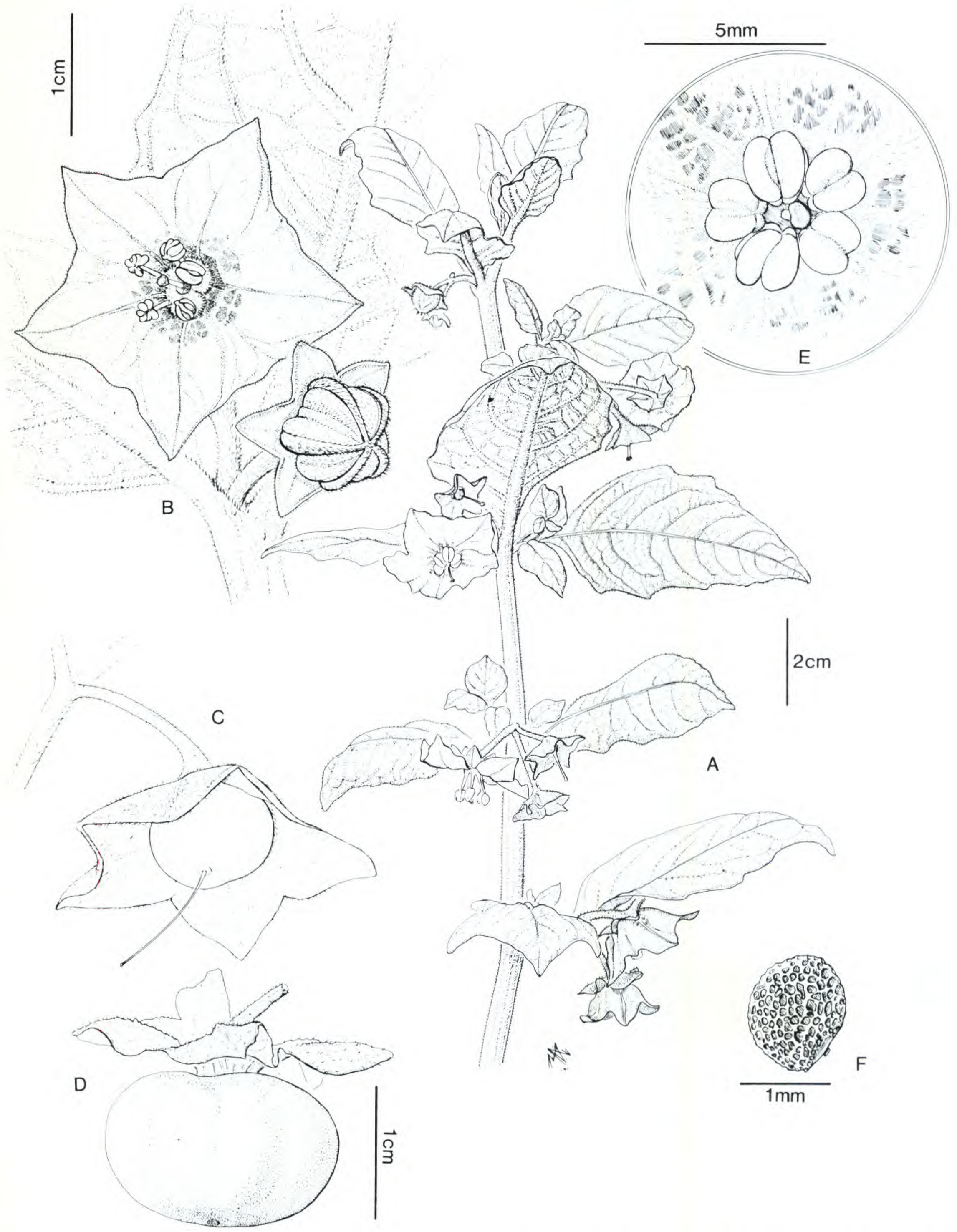

Figure 1. *Jaltomata grandiflora* (Robinson & Greenmann) D'Arcy, Mione & Davis. —A. Habit. —B. Flower and flower bud. —C. Young fruit. —D. Mature fruit. —E. Androecium and corolla pattern. —F. Seed. (All after *D'Arcy 17749*, MO.)

mens subequal, anthers yellow, ovoid, 3–3.5 mm long before dehiscence (2 mm after) and lobed ca. 1 mm below the connective, ventrifixed near the base of the connective, deeply creased on the dorsal side and along the stomia, not apiculate, filaments white, erect, subulate, apically glabrous, basally tufted, ca. 7 mm long; pollen yellow; disk pale yellow or orange, surrounding the basal half of the ovary and immersed beneath the corolla tube and filament bases; ovary green, hemispherical, style ca. 7 mm long, glabrous, stigma dark green, hemispherical, 1 mm across, situated among the anthers; ovules ca. 200. Berry black, juicy, depressed globose, 9.2–12 × 14–18 mm across; fruiting calyx porrect, becoming brownish; seeds ca. 90. Chromosomes (mitotic) $2n = 24$.

Additional material examined. MEXICO. MICHOACAN: near Km 35 on route 120 to Santa Clara from Patzcuaro in old pine-oak forest, 2,004 m, 24–25 July 1977 (in bud), *Davis 776* (MO); Patzcuaro area ca. 1 mi. past microwave tower, 1.8 mi. past Los Tanques pueblo, 3 July 1982 (st), *Davis 1114* (MO); progeny of seed from *Davis 1114* grown at Missouri Botanical Garden, *D'Arcy 17749* (MO); grown at University of Connecticut, *Mione 454* (COLO, CONN, MEXU).

Jaltomata grandiflora is known only from three collections made in the Patzcuaro region of central Michoacán, which is about halfway between Morelia and Uruapan, 19°30′N, 101°35′W. The region is of Quaternary and Tertiary extrusive exposures (Atlas Nacional del Medio Físico, 1981: 145).

As more material is grown, duplicates will be distributed to other institutions.

In cultivation, the species appears to tolerate a limited temperature range, 18°–23°C. At lower and higher temperatures, growth declines and plants decrease in size, flower buds fail to appear, and buds already present fail to develop into flowers. This narrow temperature tolerance may partly account for the limited distribution of the species in nature, although many other species have similar temperature requirements. For plants in our North American greenhouses, this means blooming is restricted to a few weeks in spring and autumn. Flowering plants were found in nature in July and August.

Jaltomata grandiflora is easily distinguished from other members of the genus by its velutinous, soft leaves and stems, and by its large, pentagonal, spotted flowers. Although minute droplets can be seen at the tips of many of the hairs of the indumentum, the plants are not viscid. The markings on the corolla, green against a yellowish white background, are a series of spots arranged in a star, resembling the markings in *Leucophysalis grandiflora* (Hook.) Rydberg, *L. viscosa* (Schrader) Hunz, *Physalis franchetii* Masters, *P. greenmannii* Waterfall, and *P. stapelioides* (Regel) Bitter. These species are all members of the physaloid group (subtribe Physalidinae Miers) of Solanaceae, which includes about a dozen genera centered in northern Mexico (*Chamaesaracha*, *Jaltomata*, *Margaranthus*, *Physalis*, *Quincula*) but is also represented in temperate Asia (*Physaliastrum*, *Physalis*) and in tropical America (*Deprea*). Corollas of most other members of the group are either unmarked or the maculae are in solid blotches. The spotted corolla of *Jaltomata grandiflora* is shown in Figure 1E, and that of *Leucophysalis grandiflora* is illustrated by D'Arcy et al. (1990). Another unusual feature is the rootstock, which one collector (Davis) recorded as "Wow! what a large rootstock!" Such enlarged roots may be otherwise unknown in the physaloid group of genera.

Jaltomata grandiflora, based on our analysis of morphological similarity (including fruit color) and chloroplast DNA characters, is clearly a member of the herbaceous, black/purple fruited clade (one of two major clades of *Jaltomata*). This species, based on cpDNA characters, is basal; it is the sister taxon to all other species of the black/purple fruited clade.

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Two New Species of *Paspalum* (Poaceae: Paniceae) from Venezuela and Colombia

Gerrit Davidse
Missouri Botanical Garden, P.O. Box 299, St. Louis, Missouri 63166-0299, U.S.A.

Fernando Zuloaga
Instituto de Botánica Darwinion, Casilla de Correo 22, San Isidro (1642), Argentina

ABSTRACT. Morphological characters support the description of two new species of *Paspalum: P. atabapense*, from Depto. Atabapo, Venezuela, in group Alterniflora; and *P. tillettii*, from Comisaría del Guainía, Colombia, and Territorio Federal Amazonas, Venezuela, in an unspecified taxonomic group but clearly related to *P. schultesii* Swallen.

Preparatory to completing an account of the genus *Paspalum* for the *Flora of the Venezuelan Guayana*, two new species are described and illustrated.

Paspalum L., with more than 350 species, is one of the largest genera of grasses. It is confined primarily to the New World, although a few species occur in Africa, Asia, and Oceania. Several species are pantropical or nearly so, and two weedy species have now become widely naturalized as weeds in the tropics. A few have been widely distributed as forage grasses and have subsequently become naturalized in new areas. The most useful taxonomic treatment of this genus remains the monograph of the North American species (including Mesoamerica) by Chase (1929).

Paspalum atabapense Davidse & Zuloaga, sp. nov. TYPE: Venezuela. Amazonas: Depto. Atabapo, SE bank of the middle part of Caño Yagua at Cucurital de Yagua, 3°36′N, 66°34′W, 120 m, 8 May 1979, *G. Davidse, O. Huber & S. S. Tillett 17414* (holotype, MO; isotypes, IAN, SI, US, VEN). Figure 1.

Gramen perenne caespitosum; culmi 45–75 cm alti. Folia basalia; ligulae 0.5–1.2 mm longae, glabrae; laminae 6–18.5 cm × 0.3–0.4 mm, filiformes. Racemus 1, 3–9.5 cm longus; rhachis 0.4–0.5 mm lata, exalata vel interdum anguste alata basin versus. Spiculae 2.6–3.6 × 1.0–1.3 mm, ellipticae anguste, singulares, pubescentes; gluma inferna absens; gluma supera 0.3–0.7 mm spicula brevior. Flosculus superus 2.6–3.5 × 1.0–1.3 mm, stramineus. Antherae 1.5–1.9 mm longae.

Caespitose, perennial herbs. Culms 45–75 cm long, erect, unbranched above the base, with 2–3 nodes above the base; internodes cylindric, glabrous; nodes dark, glabrous or pilose. Leaves basal. Sheaths striate, rounded, densely pilose toward the base with appressed, whitish hairs, to sparsely pilose toward the apex, the margins glabrous. Ligules 0.5–1.2 mm long, membranous, glabrous, erose. Blades 6–18.5 cm long, 0.3–0.4 mm wide, filiform, involute, the adaxial surface scabrous, prominently ridged, the abaxial surface glabrous, the apex permanently involute, somewhat pungent. Inflorescences terminal, long-exserted; peduncle 4–17 cm long, cylindric, glabrous; raceme 1, 3.0–9.5 cm long, slightly arching, densely pilose at its base; rachis 0.4–0.5 mm wide, puberulent to glabrous, concavo-convex, unwinged or sometimes with partially developed wings 0.1–0.2 mm wide near a portion of the base, terminating in a spikelet; pedicels 0.1–0.3 mm long, densely short-pilose. Spikelets 2.6–3.6 mm long, 1.0–1.3 mm wide, solitary, plano-convex, narrowly elliptic, pilose. Lower glume always absent. Upper glume 2.4–3.0 mm long, 0.3–0.7 mm shorter than the upper floret, acute, 3-nerved. Lower floret sterile. Lower lemma as long as the spikelet, 3-nerved, glabrous to puberulent in the middle portion, pilose toward the margins. Lower palea usually absent, rarely developed and then to ⅝ as long as the lower lemma. Upper floret 2.6–3.5 mm long, 1.0–1.3 mm wide, as long as the spikelet, bisexual, narrowly elliptic, stramineous, chartaceous, smooth, papillose, the papillae regularly distributed; lemma 3-nerved, short-pilose, with prickle hairs at the apex. Stamens 3; anthers 1.5–1.9 mm long, purple. Styles 2, separate; stigmas about as long as the styles, plumose. Caryopsis (1.2–)1.4–1.5 mm long, 0.9–1.0 mm wide, obovate in outline; hilum punctiform; embryo ca. ⅖ as long as the caryopsis.

Paratypes. VENEZUELA. AMAZONAS: Depto. Atabapo, area between the W base of Cerro Yapacana and the headwaters of Caño Cotúa, 3°38′N, 66°52′W, 6 May 1979, *Davidse, Huber & Tillett 17251* (K, MO, SI, US, VEN); Depto. Atabapo, sabanas y bosques ribereños en los alrededores de Canaripó, en la margen izquierda (Sur) del bajo Río Ventuari, a unos 20 km al E de la confluencia

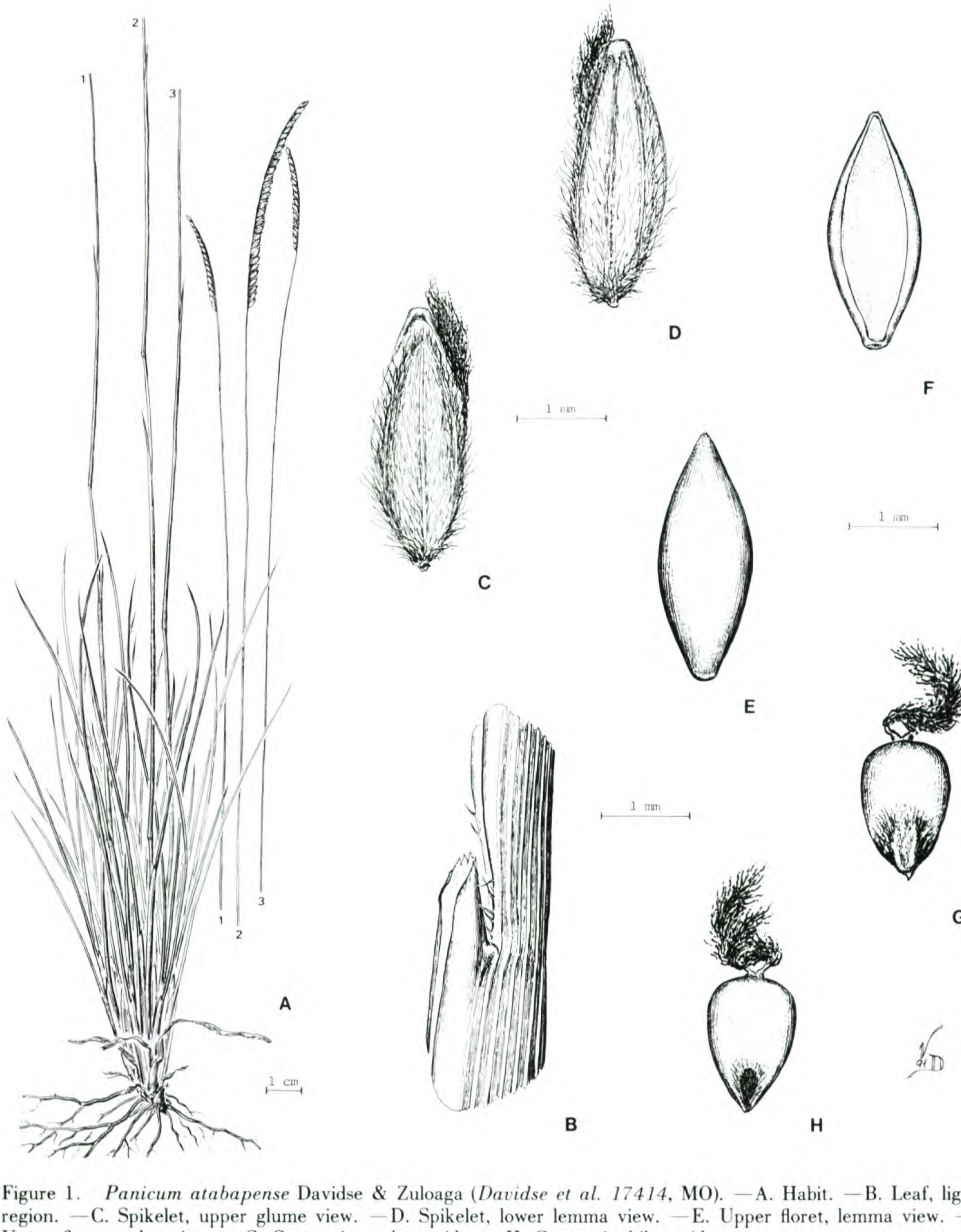

Figure 1. *Panicum atabapense* Davidse & Zuloaga (*Davidse et al. 17414*, MO). —A. Habit. —B. Leaf, ligular region. —C. Spikelet, upper glume view. —D. Spikelet, lower lemma view. —E. Upper floret, lemma view. —F. Upper floret, palea view. —G. Caryopsis, embryo side. —H. Caryopsis, hilum side.

con el Río Orinoco, 4°03′N, 66°49′W, 98 m, 30 May 1978, *Huber 1906* (MO, NY, VEN); Depto. Atabapo, tercera sabana al pié W del Cerro Yapacana, 3°38′N, 66°52′W, 100 m, 3 June 1978, *Huber 2023* (MO, NY, VEN).

This species is known so far only from a ca. 70× 40-km area in the Depto. Atabapo, Territorio Federal Amazonas, Venezuela, where it grows in open, white-sand savannas, at approximately 100 m elevation.

Paspalum atabapense appears to fit best in the informal West Indian group Alterniflora of Chase (1929) because it is perennial, caespitose, and has filiform basal leaves and solitary inflorescences with solitary spikelets. Although this group appears to be a heterogenous assemblage, *P. atabapense* is almost

certainly closely related to the Cuban endemic *P. rottboellioides* C. Wright. *Paspalum rottboellioides* differs from *P. atabapense* in its winged rachis up to 1.5 mm wide (vs. essentially wingless rachis 0.4–0.5 mm wide), spikelets with the upper glume as long as the upper floret and covering it (vs. 0.3–0.7 mm shorter than the upper floret and exposing its apex), lower lemma pilose at the base (vs. glabrous to puberulent in the middle and pilose along the margins), and blades densely papillose-pilose (vs. scabrous adaxially and glabrous abaxially).

The specific epithet refers to the Depto. Atabapo, where all four known collections originated.

Paspalum tillettii Davidse & Zuloaga, sp. nov. TYPE: Venezuela. Amazonas: Depto. Atabapo, Cucurital de Caname, S bank of the middle part of Caño Caname, 3°40′N, 67°22′W, 100 m, 30 Apr.–1 May 1979, *G. Davidse, O. Huber & S. S. Tillett 16920* (holotype, MO; isotypes, SI, US, VEN). Figure 2.

Gramen perenne caespitosum; culmi 23–62 cm alti. Folia basalia; ligulae 0.2–0.5 mm longae, ciliolatae; laminae 4–17 cm × 0.3–0.6 mm (1.0–1.5 mm latae ubi complanatae). Racemi 2, 1.5–6 cm longi, conjugati; rhachis 0.2–0.5 mm lata, exalata alis. Spiculae 1.4–1.8(–2.2) × 0.7–0.8(–1.0) mm, ellipticae, singulares, pubescentes; gluma inferna absens vel raro ½–⅔–plo spicula longior; gluma supera plerumque 0.3–0 mm spicula brevior, raro ad 0.3 mm spicula longior. Flosculus superus 1.4–1.8 (–2.0) × 0.7–0.8(–1.0) mm, ellipticus, atrobrunneus nitidus. Antherae 0.8–1.0 mm longae.

Tufted, caespitose, perennial herbs. Culms 23–62 cm tall, erect, unbranched above the base; internodes glabrous or sparsely pilose; nodes dark, sparsely pilose at the basal nodes, sparsely glabrous or pilose on the flowering culms. Leaves mostly basal, erect. Sheaths striate, rounded, the margins membranous, the basal ones strongly pilose toward the base, the upper ones usually glabrous to sparsely pilose, sometimes the entire sheath prominently pilose. Ligules 0.2–0.5 mm long, membranous, ciliolate, often with hairs to 2.3 mm long in the back at the base of the blade. Blades 4–17 cm long, 0.3–0.6 mm wide, filiform, usually involute, sometimes flattened in the middle and then 1.0–1.5 mm wide, usually glabrous except for a dense row of whitish hairs to 3.2 mm long behind the ligule and at the sheath apex and sometimes with the lowest portion of the margins ciliate, or sometimes the lower half or the entire abaxial surface pilose, the adaxial surface prominently ridged; upper blades reduced. Inflorescences terminal, exserted; peduncle 8–22 cm long, cylindric, glabrous; racemes 2, 1.5–6 cm long, conjugate, usually with a dense tuft of white hairs 2–4 mm long at the base; rachis 0.2–0.5 mm wide, flexuous, glabrous, triquetrous, without wings, terminating in a spikelet; pedicels 0.2–0.5 mm long, glabrous to sparsely pilose. Spikelets 1.4–1.8(–2.2) mm long, 0.7–0.8(–1.0) mm wide, solitary, planoconvex, elliptic, dark, densely to sparsely pilose. Lower glume usually absent, rarely present (*Davidse et al. 16920*), lanceolate, ½–⅔ as long as the spikelet, pilose. Upper glume usually as long as or to 0.3 mm shorter than the upper floret, rarely to 0.3 mm longer, obtuse, covered with capitellate hairs toward the margins, nearly glabrous in the center to uniformly pilose, 3-nerved with obscure nerves. Lower floret sterile. Lower lemma 2–3-nerved, the nerves obscure, short-pilose toward the upper margin, otherwise glabrous or sparsely pilose. Lower palea absent. Upper floret 1.4–1.8(–2.0) mm long, 0.7–0.8(–1.0) mm wide, bisexual, elliptic, dark brown, smooth and shining, indurate, minutely papillose with microhairs at the lower margins of the lemma, otherwise glabrous. Stamens 3; anthers 0.8–1.0 mm long. Styles 2, separate; stigmas about as long as the styles, plumose, purple. Caryopsis 0.8–1.0 mm long, 0.6–0.8 mm wide, obovate in outline; hilum punctiform; embryo ca. ⅖ as long as the caryopsis.

Paratypes. VENEZUELA. AMAZONAS: Depto. Atabapo, Caño Caname (afluente derecho del medio Río Atabapo), sabanas de Cucurital, aprox. 20 km al E de la boca, 3°40′N, 67°22′W, 100 m, *Huber, Tillett & Davidse 3702* (MO, VEN); Depto. Río Negro, extensa sabana en la margen derecha del bajo Río Pasimoni, 1°35′N, 66°33′W, 125 m, 8 Feb. 1981, *Huber & Medina 5845* (MO, VEN); pequeña sabana ubicada en la margen derecha (E) del bajo Río Pasimoni, a unos 3 km al E del Río, 1°38′N, 66°32′W, 125 m, 9 Feb. 1981, *Huber & Medina 5889* (VEN); Depto. Atabapo, white-sand savanna on the N bank of the lower part of Caño Caname, ca. 3 km W of Macaval, 3°41′N, 67°23′W, 95 m, 2 May 1979, *Davidse, Huber & Tillett 17078* (K, MO, PRE, VEN); Depto. Atabapo, white-sand savannas on the N bank of Caño Caname, nearly opposite Cucurital de Caname, 3°40′N, 67°22′W, 95 m, 2 May 1979, *Davidse, Huber & Tillett 17050* (MO, VEN); Depto. Atabapo, area between the W base of Cerro Yapacana and the headwaters of Caño Cotúa, 100 m, 3°38′N, 66°52′W, 100 m, 6 May 1979, *Davidse, Huber & Tillett 17216* (INA, MEXU, MO, US, VEN). COLOMBIA. GUAINIA: near Coitara, ca. 7 km S of San Fernando de Atabapo, white-sand area adjoining a laja on the W bank of the Río Atabapo, 3°55′N, 67°43′W, 95 m, 28 Apr. 1979, *Davidse 16824* (MO).

This species is known from the Comisaría del Guainía, Colombia, and the Territorio Federal Amazonas, Venezuela, where it grows in open white-sand savannas at an elevation of 95–220 m.

Paspalum tillettii is very closely related to *P. schultesii* Swallen, which is only known from the nearby Comisaría del Vaupés, Colombia. Both spe-

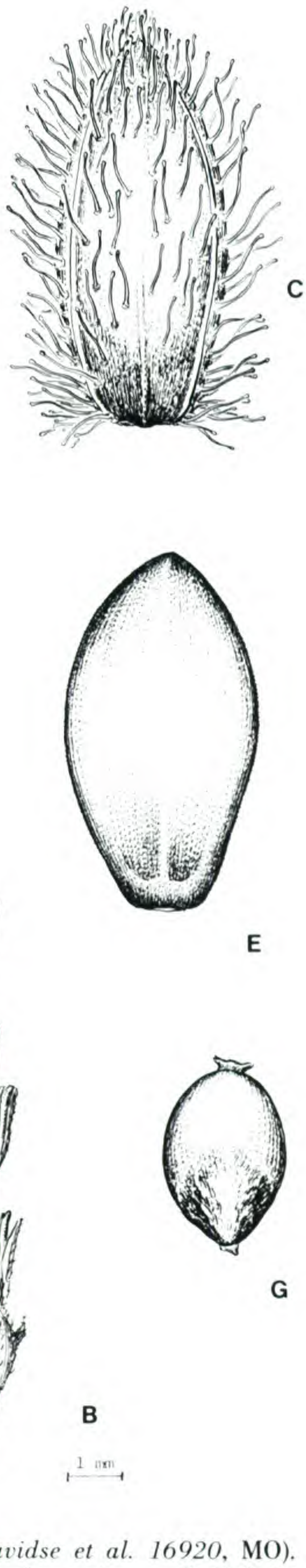

Figure 2. *Paspalum tillettii* Davidse & Zuloaga (*Davidse et al. 16920*, MO). —A. Habit. —B. Portion of a raceme with spikelets and pedicels. —C. Spikelet, upper glume view. —D. Spikelet, lower lemma view. —E. Upper floret, lemma view. —F. Upper floret, palea view. —G. Caryopsis, embryo side. —H. Caryopsis, hilum side.

cies have filiform, involute leaf blades, conjugate racemes, and a dark brown, shiny upper floret. This combination of characters is not known in any of the informal groups recognized by Chase (1929), and this combination also caused Swallen (1967) to exclude *P. schultesii* from any known group when describing this species. The dark brown, shiny upper floret is characteristic of all species of the Plicatula group, but conjugate racemes are not known in that group. Conjugate racemes (*P. multicaule* Poiret, *P. clavuliferum* C. Wright) and capitellate hairs (*P. parviflora* Rhodé, *P. multicaule*, *P. clavuliferum*) occur in the Parviflora group, but none of the species in this group have a shiny, dark brown upper floret.

Paspalum schultesii differs from *P. tillettii* in having leaves about as long as (vs. ¼–½ as long as)

the flowering culms, basal sheaths with rufous (vs. white) hairs, spikelets lanceolate (vs. elliptic), 2.4–3× 1.1–1.2 mm (vs. 1.4–1.8(–2.2)× 0.7–0.8(–1.0) mm), and an acute upper glume 0.2–0.5 mm longer than the upper floret (vs. an obtuse upper glume as long as or 0.1–0.3 mm shorter). Although most spikelets are glabrous in *P. schultesii*, a few of the spikelets of the type collection have capitellate hairs. In both species these hairs are only inconspicuously enlarged at their tips in comparison to those of the Parviflora group. Nevertheless, all these capitellate hairs may be fundamentally of the same kind, and because such specialized hairs are relatively uncommon in the genus, they may prove to be good indicators of relationships. *Paspalum tillettii*, as here circumscribed, is variable in leaf pubescence and spikelet shape and pubescence.

The two collections (*Huber & Medina 5845, 5889*) from Depto. Río Negro have leaves that are conspicuously pilose nearly throughout, in contrast to the more nearly glabrous leaves of the northern collection from Colombia and Depto. Atabapo.

Certain collections (i.e., *Davidse et al. 17216, 17078*) appear to consist of two kinds of plants, one with spikelets 1.5–1.8 mm long and another with spikelets 1.8–2.2 mm long but about as wide as the first. The latter kind has obtuse upper glumes as long as or to 0.2–0.3 mm longer than the upper floret, and it varies in the direction of *P. schultesii*. This pattern of variation suggests the possibility of hybridization. It would be worthwhile in future work to look for additional intermediate populations to determine whether such plants represent hybrid swarms between two hybridizing species. The white-sand savannas in the eastern Colombian llanos are interspersed with other kinds of soils, and this creates a mosaic of vegetation types, certainly a setting that might be favorable for the maintenance of hybrid swarms.

Another collection (Venezuela. Amazonas: Depto. Atures, transecto desde matorral ribereño hasta bosque bajo ralo, en la margen izquierda del Caño "Cabeza de Manteco," afluente del Río Autana, en el "Raudal Manteco," 4°52′N, 67°27′W, 100–120 m, 10 Nov. 1984, *Guánchez & Melgueiro 3423* (MO)) is related to this species pair but is at the moment excluded from both *P. schultesii* and *P. tillettii*. In its overall leaf, inflorescence, and spikelet morphology it resembles both species. Its leaves are as long as the flowering culms and the hairs on the basal sheaths are rufous; and its spikelets are 1.8–2.3× 1–1.1 mm. In the first two characters it resembles *P. schultesii*, and in the latter, *P. tillettii*. However, it differs from both in its unusually broad pedicels.

This species is dedicated to a valued field companion, Stephen S. Tillett, Universidad Central de Venezuela, Caracas, Venezuela, in recognition of his outstanding contributions to Venezuelan botany through teaching, collecting, curation, and research.

Acknowledgments. Fieldwork by Davidse was conducted with the support of NSF grant INT grant 76-14750 (United States) and a CONICIT grant to Otto Huber (Venezuela). Davidse thanks Otto Huber and Stephen S. Tillett for the opportunity to join their stimulating field expeditions. We thank Vladimiro Dudás for the illustrations, and Tarciso S. Filgueiras for critical comments on the manuscript and help with the Latin descriptions.

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Passiflora brachyantha (Passifloraceae), a New Species from the Andes of Southern Ecuador

Linda K. Escobar
Department of Biology, University of Puerto Rico,
Río Piedras, Puerto Rico 00931

ABSTRACT. A new species of *Passiflora* subg. *Tacsonia* is described from the Andes of southern Ecuador. *Passiflora brachyantha* is placed in section *Bracteogama*, where it most closely resembles another short-flowered species, *P. glaberrima*, which is endemic to Peru.

Members of *Passiflora* subg. *Tacsonia* (A. L. Juss.) Triana & Planchon, are tendriled lianas confined to high Andean habitats, distributed from the Cordillera de Mérida in northwestern Venezuela to Bolivia. One cultivated species, *Passiflora pinnatistipula* Cav., is found in mesic sites in the Andes of Chile. The plants are characterized by long-tubed, highly colored, hummingbird-visited flowers, and the geographical distribution of the plants coincides with that of *Ensifera ensifera*, the sword-billed hummingbird (Escobar, 1980, 1989b; Schauensee, 1982). Hypanthium length in the subgenus varies, however, and falls mainly into two groups: (1) long-tubed species probably pollinated by *Ensifera ensifera*, as is the most widespread species, *Passiflora mixta* L. f. (Snow & Snow, 1980), and (2) shorter-tubed species presumably pollinated by shorter-billed hummingbirds. There are few species of intermediate hypanthium length (Escobar, 1980). Since all of the subgenera of *Passiflora* that are confined to the high Andes produce flowers adapted for hummingbird pollination (Escobar, 1989b, and unpublished data), it is likely that the short-tubed taxa, which are most common in southern Ecuador and northern Peru, have speciated in response to the selective pressures exerted by their pollinators.

Section *Bracteogama* (DC.) L. Escobar comprises 14 of the 47 species placed by Escobar in subgenus *Tacsonia* (Escobar, 1980, 1987, 1988, 1989a) and has its center of diversity in the moist montane forests of southern Ecuador and the eastern Andean slopes of northern Peru around the Huacabamba depression. The members of the section are recognized by the presence of large, coriaceous, mostly connate bracts that enclose and presumably protect the bud during development (Escobar, 1980; Harms, 1925). Both long-flowered and short-flowered species occur in this section. The new species described here is another short-flowered member of section *Bracteogama*.

Passiflora brachyantha L. Escobar, sp. nov. TYPE: Ecuador. Loja: 8 km W of Loja on road to Catacocha, 7,400 ft., 30 Jan. 1979 (fl, fr), *R. M. King & F. Almeda 7887* (holotype, US). Figure 1.

Differt a *Passiflora glaberrima* (A. L. Juss.) Poiret caulibus foliis bracteisque pubescentibus, foliis majoribus apicibus acuminatis, et floribus roseis.

Lianas with stout tendrils, pubescent on stems, petioles, peduncles, bracts, and abaxial surface of leaves and stipules, with straight to wavy, transparent trichomes to 0.5 mm long. Stems angulate, striate. Leaf blades 3-lobed, 3.5–7.3 cm long, 7.8–11.0 cm wide, parted ca. ¾ their length into 3 elliptic segments, acuminate at apex of lobes, shallowly cordate at base, glandular-serrate at margins, coriaceous; lateral segments 2.2–5.5 cm long, 1.6–3.4 cm wide, divergent from mid-segments ca. 90°; mid-segments 3.5–7.3 cm long, 1.6–3.3 cm wide; petioles 1.2–2.7 cm long, with 3–5 subspherical nectaries 0.7–1.2 mm long, 0.8–1.0 mm wide, scattered on upper half of adaxial surface; stipules reniform, concave, 1.2–1.5 cm long, ca. 6 mm wide, attenuate at apex, oblique at base, shallowly glandular-serrulate at margins, coriaceous, glabrous on adaxial surface. Peduncles slender, 2.7–3.4 cm long, bearing pendent flowers; bracts oblong, connate ca. ¾ their length from base, forming an ampliate tube at base of hypanthium, each bract 3.1–3.5 cm long, 1.0–1.1 cm wide, acuminate at apex. Flowers 6.4–6.8 cm long, ca. 3.5 cm wide, bright pink; hypanthium 3.9–4.0 cm long, 0.4–0.6 cm wide (pressed), dilated at base, pubescent on outer surface with straight, transparent trichomes ca. 0.3 mm long; sepals oblong, ca. 2 cm long, ca. 0.6 cm wide, pubescent with subterminal aristae ca. 1 mm long on abaxial surface; petals subequal to sepals; corona tuberculate, ca. 0.3 mm long; ovary ellipsoidal, pubescent with fine, straight trichomes ca. 0.1 mm

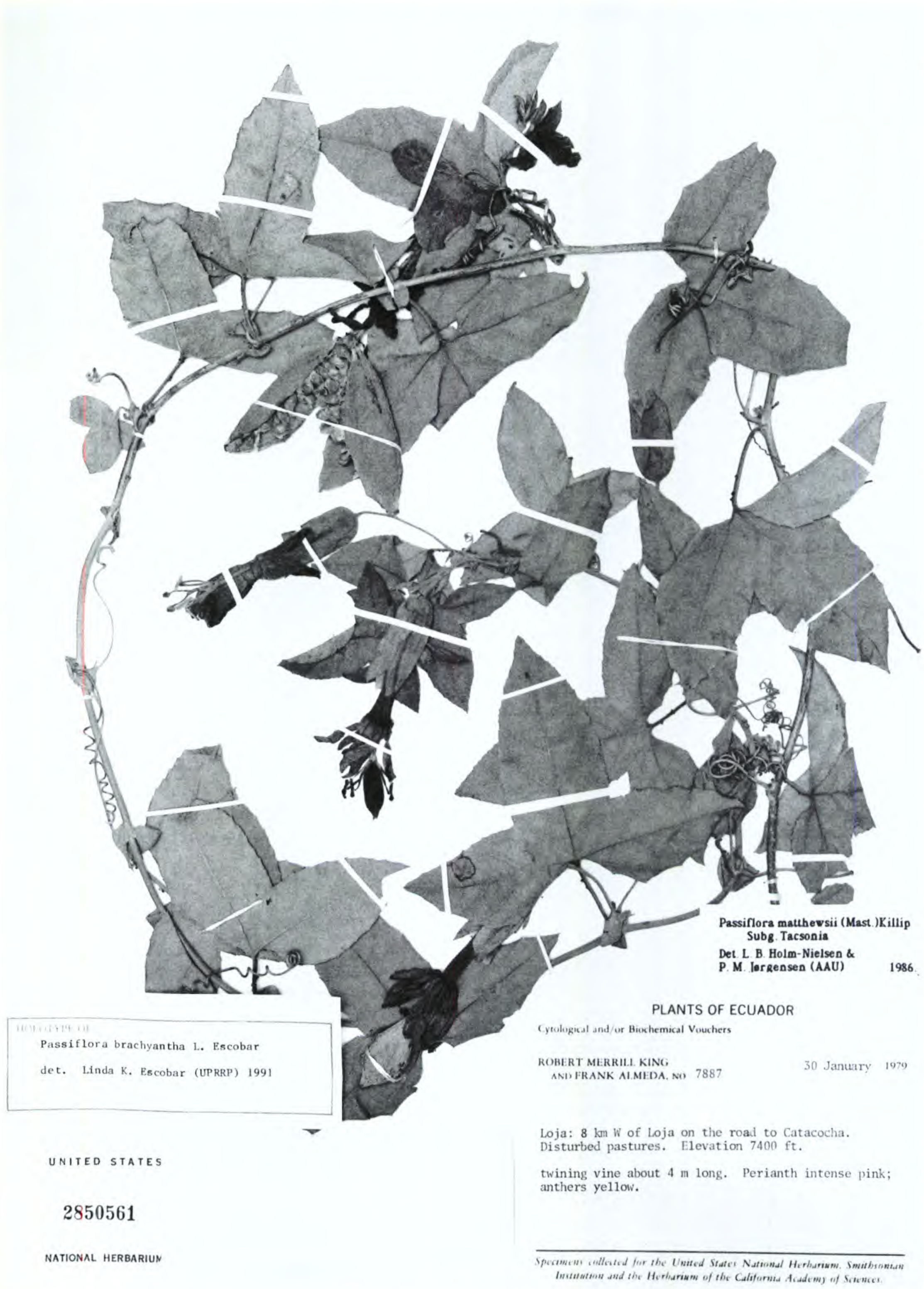

Figure 1. Holotype of *Passiflora brachyantha* L. Escobar, deposited at US.

long. Fruit ellipsoidal, ca. 5.5 cm long, ca. 2.2 cm wide (pressed), strongly coriaceous, green; seeds obovate, ca. 5.5 mm long, ca. 3.8 mm wide, with reticulate pitting on testa.

Passiflora brachyantha most closely resembles the Peruvian species *P. glaberrima* (A. L. Juss.) Poiret by virtue of the general shape of the leaves, the slender peduncles, and small flowers. It differs from *P. glaberrima* in being pubescent, possessing much larger leaves with acuminate apices, and in having pink rather than blue-violet flowers. It is known only from the type collection.

Acknowledgments. I gratefully acknowledge the University of Antioquia, Medellín, Colombia, and the Fulbright Commission, Ecuador, for financial aid for the original studies of subgenus *Tacsonia*, and that of COLCIENCIAS Grant 10019-1-39-82 for subsequent work. The Plant Resources Center, University of Texas, Austin, has provided space and facilities for the present study. I am indebted to Guy Nesom for the Latin diagnosis and to B. L. Turner for a critical reading of the manuscript. Finally, I thank the staff of US for loan of the specimen here designated as the holotype of *Passiflora brachyantha.*

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Gurania sessiliflora (Cucurbitaceae), a New Species from Panama

Rachel Jane Hampshire
The Natural History Museum, Cromwell Road, London SW7 5BD, England

ABSTRACT. A new Panamanian species, *Gurania sessiliflora*, is described. The species appears most similar to *Gurania coccinea* Cogn. Description of *G. sessiliflora* brings the number of *Gurania* species in Mesoamerica to seven. A key to the Mesoamerican species of *Gurania* is given, followed by a list with synonyms and distributions in Mesoamerica.

During my study of Central American specimens of *Gurania* and *Psiguria* for *Flora Mesoamericana*, the new species *Gurania sessiliflora* was found.

Gurania sessiliflora R. J. Hampshire, sp. nov. TYPE: Panama. Darién: Cerro Pirre, along river by Rancho Frío, 7°58′N, 77°42′W, 600 m, 9 Aug. 1986 (fl), *McDonagh, Lewis, Gumpel & Plumptre 620* (holotype, BM). Figure 1.

Species *G. coccineae* Cogn. similis, sed floribus sessilibus, planta omnino glabrata (nec pilosa nec villosa), foliis integris vel raro lobatis (nunquam foliolatis) differt.

Monoecious vines; tendrils simple; stems slender, striate, glabrate, green or pale brown, the epidermis sometimes flaking. Leaf blades 12–17.5 × 7–13 cm, cordiform to broadly ovate, simple, unlobed, or rarely 2–3-lobed, the apex long-acuminate, glabrate, the base cordate or truncate, the margin remotely dentate; petioles 3.5–7 cm, the epidermis of the basal half flaking, glabrate. Staminate inflorescences axillary, subcapitate; peduncles 9–12.5 cm, ± glabrous; flowers sessile, the apex of the peduncle clearly scarred where earlier flowers have been, the scars congested; calyx tube 4–6 mm, urceolate, glabrous, orange, the lobes 5, ca. 2 mm, conical, glabrous; corolla lobes 5, 2–3 mm, lanceolate, papillose, yellow; anthers 2, ca. 3 mm, oblong, initially straight, spiraling slightly after anthesis, the appendage ca. 0.5 mm, papillose. Female flowers not seen. Fruit not seen.

Paratype. PANAMA. DARIEN: Cerro Pirre, cloud forest and/or mossy forest, ca. 2,500–4,500 ft., 9–10 Aug. 1967, *Duke & Elias 13686E* (MO).

Gurania sessiliflora is clearly distinct from other species of *Gurania*, but is closest to *G. coccinea*. However, *G. coccinea* has distinctly pedicellate flowers (with pedicels 4–15 mm long) and pedicel scars that are evenly spaced at the apex of the peduncle, while *G. sessiliflora* has sessile flowers, with the scars from fallen flowers very congested at the tip of the peduncle. *Gurania coccinea* is usually pilose, or sometimes villous or glabrate, while the new species is glabrate. The leaves of *G. coccinea* are unlobed, 2–3-lobed or (in Panama) 3-foliolate, while those of the new species are unlobed or rarely 2–3-lobed, but never foliolate. It is assumed that, like other species of *Gurania* and *Psiguria*, *G. sessiliflora* will prove to be monoecious (Condon & Gilbert, 1990). A dissected flower of the paratype had three smaller anthers, but is assumed to be an aberrant specimen.

The new species is found in cloud or elfin forest at elevations of 600–1,500 m in the Cerro Pirre area of Darién, Panama. The holotype was collected by four undergraduates from the University of Bristol, England, who made a collection of interesting material while on an expedition to Panama.

Many authors have said the genera *Psiguria* and *Gurania* need revision. Wunderlin (1978) was uncertain whether the two genera were distinct, while Condon & Gilbert (1990) and Jeffrey (1978) acknowledged the need for revision of both genera. For *Flora Mesoamericana* I have treated the species in the broadest sense, reducing to synonymy names which, following a more detailed study, may prove distinct. Following this policy, *G. sessiliflora* brings the total number of *Gurania* species in Mesoamerica (from Tabasco, Yucatan, and Chiapas to the Panama–Colombia border) to seven. A key to the Mesoamerican species of *Gurania* is given below, followed by a list with synonyms and distributions in Mesoamerica.

1a. Older stems corky; calyx tube of male flowers longer than 1 cm; male flowers on pedicels 1–3 cm ..... 7. *G. tubulosa*

1b. Stems never corky; calyx tube of male flowers usually less than 1 cm; male flowers on pedicels usually less than 1 cm.

2a. Calyx lobes of staminate flowers ca. 2 mm (Darién Province, Panama).

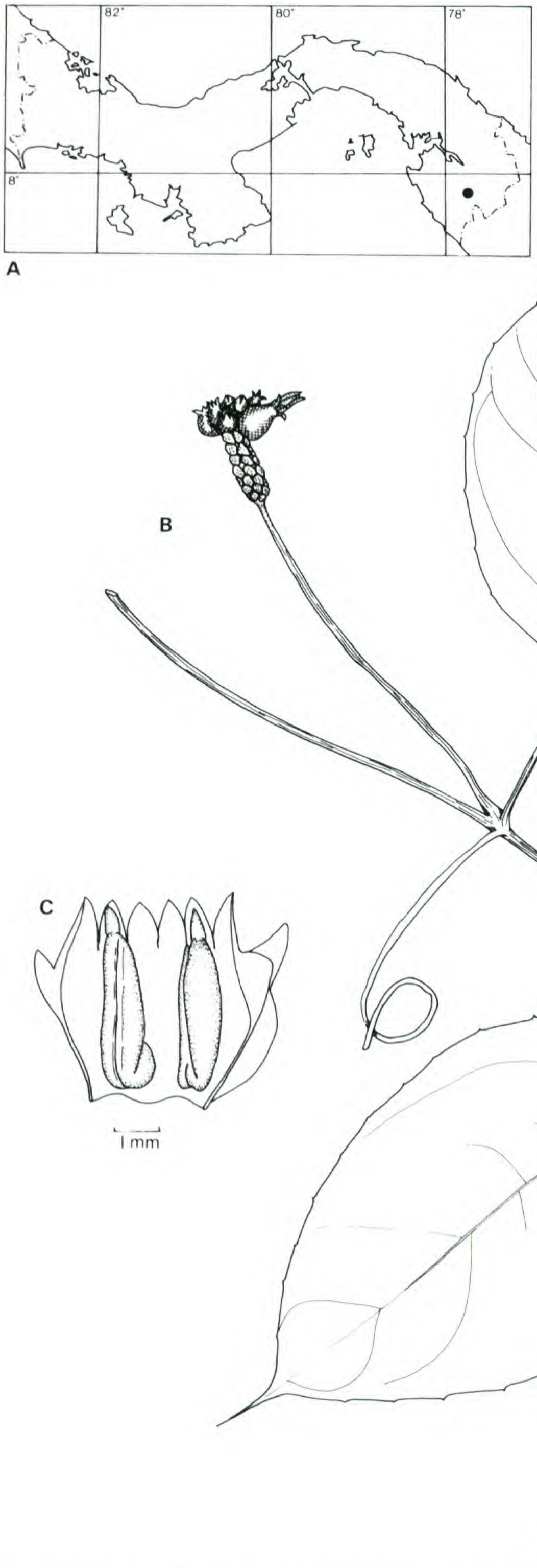

Figure 1. *Gurania sessiliflora* R. J. Hampshire. —A. Map of Panama, showing the position of Cerro Pirre, the type locality. —B. Habit. —C. Dissected male flower showing position of the anthers.

3a. Male inflorescences on peduncles longer than 35 cm; leaves hispidulous beneath .. 1. *G. brevisepala*
3b. Male inflorescences on peduncles shorter than 13 cm; leaves glabrate ..... 5. *G. sessiliflora*
2b. Calyx lobes of staminate flowers longer than 2 mm (Chiapas–Panama).
4a. Fruit villous; stems villous with hairs 4–6 mm long; male flowers subsessile ..... 3. *G. eriantha*
4b. Fruit glabrous; stems sometimes villous, the hairs usually less than 4 mm long, but if longer, the male flowers on pedicels at least 6 mm.
5a. At least some leaves foliolate ..... 2. *G. coccinea*
5b. Leaves not foliolate.
6a. Male inflorescences on peduncles longer than 29 cm ..... 6. *G. spinulosa*
6b. Male inflorescences on peduncles shorter than 24 cm.
7a. Lowest male flowers on pedicels 1–3 mm ..... 4. *G. makoyana*
7b. Lowest male flowers on pedicels at least 4 mm ..... 1. *G. coccinea*

1. *Gurania brevisepala* Cuatr.
Panama.

This species, known in Mesoamerica from two collections (*Whitefoord & Eddy 470*, BM, and *Garwood 747*, F), represents a new record for the flora of Panama. One collection is from Mamey, the other from near Jacqué, both in Darién Province.

2. *Gurania coccinea* Cogn.
Synonyms: *G. costaricensis* Cogn., *G. racemifera* Standley.
Nicaragua, Costa Rica, and Panama.

3. *Gurania eriantha* (Poeppig & Endl.) Cogn.
Synonym: *G. hirsuta* Cogn.
Costa Rica and Panama.

4. *Gurania makoyana* (Lem.) Cogn.
Synonyms: *G. donnell-smithii* Cogn. ex J. D. Smith, *G. levyana* Cogn., *G. seemaniana* Cogn., *G. tonduziana* J. D. Smith.
Chiapas, Belize, Guatemala, Honduras, Nicaragua, Costa Rica, and Panama.

5. *Gurania sessiliflora* R. J. Hampshire
Panama.

6. *Gurania spinulosa* (Poeppig & Endl.) Cogn.
Nicaragua and Panama.
This species represents a new record for Nicaragua (Jeffrey, in press) and Panama.

7. *Gurania tubulosa* Cogn.
Synonyms: *G. megistantha* J. D. Smith, *G. suberosa* Standley.
Costa Rica and Panama.

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New Western North American Taxa of *Arceuthobium* (Viscaceae)

Frank G. Hawksworth
USDA Forest Service, Rocky Mountain Forest and Range Experiment Station,
Fort Collins, Colorado 80526, U.S.A.

Delbert Wiens
Department of Biology, University of Utah, Salt Lake City, Utah 85112, U.S.A.

Daniel L. Nickrent
Department of Plant Biology, Southern Illinois University, Carbondale, Illinois 62901, U.S.A

ABSTRACT. Several new names are proposed for a taxonomic revision of the dwarf mistletoes (*Arceuthobium*). Two new species from northwestern California and southwestern Oregon are described: *A. siskiyouense*, a parasite of knobcone pine, and *A. monticola*, a parasite of western white pine. Also described as new is *A. littorum*, a parasite of Monterey and bishop pines in coastal California. *Arceuthobium tsugense* is segregated into two subspecies: subspecies *tsugense*, primarily parasitic on western hemlock, and subspecies *mertensianae*, primarily parasitic on mountain hemlock.

In preparing a revision of our monograph on dwarf mistletoes (*Arceuthobium*, Viscaceae) (Hawksworth & Wiens, 1972) and for our treatment of the Viscaceae for the new Jepson *Manual of the Flowering Plants of California*, we have continued to investigate the systematics of this economically important genus of conifer parasites (Hawksworth & Wiens, 1976, 1977, 1980, 1984, 1989; Nickrent, 1986, 1987; Nickrent & Butler, 1989, 1990, 1991; Nickrent & Stell, 1990; Nickrent et al., 1984). Here we describe three new species that parasitize pines in Oregon and California, and we also segregate the hemlock dwarf mistletoe into two subspecies. Two of the new species are endemic to the Siskiyou-Klamath Mountains floristic province of northwestern California and southwestern Oregon, an area well known for its high degree of plant endemism (Smith & Sawyer, 1988).

Only brief descriptions of the new taxa, their relationships to closely related taxa, and selected collections representing the host and geographic distribution of the new taxa are cited here. Additional descriptions, illustrations, complete specimen citations, and distribution maps will be presented in our revised monograph of the genus, which is nearing completion. The methods used for our morphological analyses are as described by Hawksworth & Wiens (1972).

Arceuthobium siskiyouense Hawksworth, Wiens & Nickrent, sp. nov. TYPE: U.S.A. Oregon: Josephine County, Oregon Mountain Road, 6 mi. SW of O'Brien, parasitic on *Pinus attenuata*, T. 41 S., R. 9 W., Sect. 9, 42°01′N, 123°46′W, elevation 650 m, 20 July 1987, *D. Wiens 6756* (holotype, US; isotypes, FPF, MO, ORE, OSC, UC).

Plantae 6–10 (8) cm altae; surculi brunnei, parce flabellate ramosi; surculi principales basi 2–2.5 mm diam., internodiis tertiis 6–15 (9) mm longis, 2 mm latis; flores staminati 3–4-meri; fructus maturi 4 mm longi, 2.5 mm lati; anthesis mense Septembri; fructus maturitas mense Septembri–Octobri. In *Pino attenuata* parasiticae.

Plants 6–10 (mean 8) cm tall, brownish, flabellately branched, predominant shoots 2–2.5 mm diam. at base, third internode from base 6–15 (mean 9) mm long and 2 mm wide; staminate flowers 3- or 4-partite; mature fruit 4 mm long and 2.5 mm wide; anthesis in September; fruits mature in September and October; parasitic principally on *Pinus attenuata*.

We previously included this dwarf mistletoe under *A. campylopodum* (Hawksworth & Wiens, 1972, 1984), but noted an anomalous situation near Gasquet, Del Norte County, California, where a dwarf mistletoe (then presumed to be *A. campylopodum*) was common on *Pinus attenuata* but rare on associated *P. ponderosa* (Hawksworth & Wiens, 1972). This situation is now readily explained, because the taxon on *P. attenuata* is *A. siskiyouense*, not *A. campylopodum*.

Arceuthobium siskiyouense is a local endemic restricted to the Siskiyou-Klamath Mountains of southwestern Oregon (Curry and Josephine counties)

TABLE 1. Comparison of some characters of *Arceuthobium siskiyouense* and *A. campylopodum* in the Siskiyou-Klamath Mountains. Means are in parentheses.

Character	*A. siskiyouense* (19 collections)	*A. campylopodum* (17 collections)
Shoot height	6–10 (8) cm	10–14 (12) cm
Basal shoot diameter	2–2.5 mm	3–6 mm
Third internode	6–15 (9) × 2 mm	11–17 (14) × 3–3.5 mm
Mature fruit	4 × 2.5 mm	6 × 3.5 mm
Witches' brooms	None	Well developed
Peak anthesis	September	August
Peak seed dispersal period	September–October	September–October
Elevational range	400–1,200 m	50–2,400 m
Parasitism of *Pinus ponderosa* and *P. jeffreyi*	Rare	Common
Parasitism of *P. attenuata*	Common	Rare

and adjacent northwestern California (Del Norte, Humboldt, and Siskiyou counties). Its known elevational range is from 400 to 1,200 m. In marked contrast, *A. campylopodum* has a wide distribution from northern Idaho and northern Washington to Baja California. The two species are sympatric in several areas but retain their distinctive morphological shoot and fruit characteristics. Their flowering periods partially overlap, but there is no evidence of hybridization between them, thus further supporting their specific status.

Pinus attenuata is the most common host of *A. siskiyouense*. The mistletoe will rarely parasitize *P. ponderosa*, *P. jeffreyi*, and *P. contorta* subsp. *contorta*, but only in areas where these species grow in close association with infected *P. attenuata*. *Arceuthobium siskiyouense* retains its morphological integrity in such "host crossovers," providing further evidence supporting its specific segregation. Furthermore, inoculation tests on *Pinus attenuata* with *A. siskiyouense* (from the Gasquet area) in the central Sierra Nevada foothills at Camino (elevation 900 m) resulted in the exceptionally high infection rate of 86 percent. Inoculations on the same host with *A. campylopodum* seed from *P. jeffreyi* on the Plumas National Forest resulted in only 11 percent infection (R. F. Scharpf, pers. comm.).

Arceuthobium siskiyouense differs from *A. campylopodum* primarily in its shorter, more slender shoots, smaller fruits, later flowering period, absence of witches' broom formation, and varying host relationships (Table 1). Electrophoretic evidence also confirms the distinctness of this taxon (Nickrent & Butler, 1991).

Paratypes: on *Pinus attenuata*, except as noted. U.S.A. CALIFORNIA: Del Norte Co., Gasquet, *Tracy 16464* (CAS, JEPS, UC, VS, WTU); Gordon Mtn., *Newcomb 165* (UC); Bear Wallows, 2 mi. N of Sanger Peak, *Kildare 8785* (CAS); 6 mi. NE of Gasquet on old toll road, on *P. ponderosa*, *Hawksworth & Wiens 867* (FPF) and on *P. contorta* subsp. *contorta*, *Hawksworth & Wiens 866* (FPF); 18 Mile Creek Canyon, Elk Camp Ridge, on *P. contorta* subsp. *contorta*, *Parks & Parks 24063* (UC); 2.5 mi. NW of Black Butte, *Tinnin & Kirkpatrick 1A* (FPF); 2 mi. S of Hazelview Summit on Rte. 199, *Hawksworth 2272* (FPF). Humboldt Co., NW of Scotia, *Miller FP98033* (PFRS). Siskiyou Co., Russian Creek, *Butler 273* (UC); 3 mi. N of Branch Guard Sta., *Kuijt 1277* (UC); 16 mi. N of Happy Camp on O'Brien rd., *Hawksworth & Hinds 1001* (FPF). OREGON: Curry Co., 12 mi. NNW of Agness, *Graham s.n.* (FPF); W side of Vulcan Peak, *Denton 3689* (WTU); SW slope of Iron Mtn., *Baker 3100* (ID). Josephine Co., O'Brien, on *Pinus contorta* subsp. *contorta*, *Weir 3187* (ILL); and on *Pinus jeffreyi*, *Lewis*, 1917 (FPF, ILL); 5 mi. W of Grants Pass, on *P. jeffreyi*, *Graham*, 1964 (FPF); Bain Station on Forest Service road 112, on *P. contorta* subsp. *contorta*, *Mathiasen 8605* (FPF); 2 mi. E of Cave Jct., *Theisen*, 1965 (FPF); near Lookout Gap, 20 air mi. S of Galice, on *P. jeffreyi*, *Graham*, 1965 (FPF); 0.5 mi. S of Galice-Agness road on Hobson Horn road, *Hawksworth 2333* (FPF); Wonder, on *P. jeffreyi*, *Mitchell FP68212* (FPF); Mt. Peavine, near Galice, *Childs FP91615* (OSC).

Arceuthobium monticola Hawksworth, Wiens & Nickrent, sp. nov. TYPE: U.S.A. Oregon: Josephine County, 7 mi. S of O'Brien on Old Gasquet Toll Road (Oregon Mountain Road); parasite on *Pinus monticola*, T. 41 S., R. 9 W., Sect. 9, 42°01′N, 123°46′W, elevation 650 m, 20 July 1987, *D. Wiens 6757* (holotype, US; isotypes, FPF, MO, ORE, OSC, UC).

Plantae 5–10 (7) cm altae; surculi brunnei, parce flabellate ramosi; surculi principales basi 2–4 (3) mm diam., internodiis tertiis 8–15 (12) mm longis, 1.5–2 mm latis; flores staminati 3-meri; fructus maturi 4–4.5 mm longi, 2–2.5 mm lati; anthesis mense Julio–Augusto; fructus maturitas mense Octobri–Novembri. In *Pino monticola* parasiticae.

Plants 5–10 (mean 7) cm tall, brownish, flabellately branched; dominant shoots 2–4 (mean 3) mm

TABLE 2. Comparison of some characters of *Arceuthobium monticola* and *A. californicum*. Means are in parentheses.

Character	*A. monticola* (26 collections)	*A. californicum* (8 collections)
Shoot color	Brownish to reddish	Yellow to greenish
Shoot height	5–10 (7) cm	6–14 (8) cm
Basal shoot diameter	2–4 (3) mm	1.5–4 (2) mm
Third internode	8–15 (12) × 2 mm	5–16 (10) × 1.5 mm
Mature fruit	4 × 2 mm	4 × 2.5 mm
Fruit color	Bluish	Greenish
Peak anthesis	July–August	July
Peak seed dispersal	October–November	September
Parasitism of:		
Pinus monticola	Common	Rare
Pinus lambertiana	Rare	Common

diam. at the base; third internode from the base 8–15 (mean 12) mm long and 1.5–2 mm wide; staminate flowers 3-partite; mature fruit 4–4.5 mm long and 2–2.5 mm wide; anthesis July and August; fruits mature in October and November; parasite principally on *Pinus monticola*.

Previously we included this taxon under *Arceuthobium californicum* (Hawksworth & Wiens, 1972). However, subsequent field and laboratory studies have demonstrated that it is a distinct species endemic to the Siskiyou and Klamath mountains of southwestern Oregon (Coos, Curry, and Josephine counties) and adjacent northwestern California (Del Norte County). Its known elevational range is from 700 to 1,600 m. To our knowledge, it is not sympatric with *A. californicum*, which is apparently confined to California.

Arceuthobium monticola differs from *A. californicum* in its much darker shoot color, later flowering and seed dispersal periods, and occurrence primarily on *Pinus monticola* (Table 2). Electrophoretic evidence also confirms the distinctness of these two taxa (Nickrent & Butler, 1991).

Paratypes: on *Pinus monticola* except as noted. U.S.A. CALIFORNIA: Del Norte Co., 0.5 mi. E of Sourdough Jct., ca. 10 air mi. N of Gasquet, *Miller*, 1969 (FPF); Black Butte, *Theisen & Bynum*, 1968 (FPF), and on *Picea breweriana*, *Mathiasen 8609* (FPF); 2.4 mi. W of Smith River near Lee Brown Crossing, *Mathiasen 8606* (FPF); 0.6 mi. N of Ship Mt. Lookout on Little Jones Creek road, *Mathiasen 8502* (FPF); 0.5 mi. N of Black Butte, *Mathiasen 8607* (FPF); 3.0 mi. E of Smith River bridge, 10 mi. N of Gasquet, *Nickrent & Wiens 2705* (FPF, ILL); Lower Coon Mtn., 1 mi. SW of Camp 6 Lookout, *Mastrogiuseppe & Mastrogiuseppe 153* (WS). OREGON: Coos Co., 13 air mi. S of Powers, *Mathiasen 8610* (FPF). Curry Co., Saddle Mtn., ca. 15 air mi. ESE of Gold Beach, *Bynum*, 1967 (FPF) and on *Picea breweriana*, *Bynum*, 1967 (FPF); 0.2 mi. N of Snow Camp Fire Lookout, *Mathiasen 8601* (FPF), and on *P. jeffreyi*, *Mathiasen 8602* (FPF); 14 mi. ESE of Gold Beach, *Wiens 6793* (FPF); Windy Creek, N of Loeb State Park, *Wiens 6794* (FPF). Josephine Co., Oregon Mt., 14 mi. SW of Cave Jct., on *P. lambertiana*, *Weir 3191* (FPF, ILL).

Arceuthobium littorum Hawksworth, Wiens & Nickrent, sp. nov. TYPE: U.S.A. California: Mendocino County, 3.0 mi. E of Noyo on State Highway 20, on *Pinus muricata*, elevation 30 m, 12 Dec. 1989, *R. L. Mathiasen 8940* (holotype, US; isotypes, CAS, FPF, HSC, MO, UC).

Plantae 10–20 (12) cm altae; surculi brunneo-virides, parce flabellate ramosi; surculi basi 2–5 (3.5) mm diam., internodiis tertiis 10–20 (15) mm longis, 2–5 (3.5) mm latis, flores staminati 4-meri; fructus maturi 3–5 mm longi; anthesis mense Augusto–Septembri; fructus maturitas mense Septembri–Octobri. In *Pino radiata* et *Pino muricata* parasiticae.

Plants 10–12 (mean 12) cm tall; brown to green, flabellately branched; dominant shoots 2–5 (mean 3.5) mm diam. at base; third internode 10–20 (mean 15) mm long and 2–5 (mean 3.5) mm wide; staminate flowers 4-partite, mature fruit 3–5 mm long; anthesis August and September; fruits mature in September and October; parasite principally on *Pinus radiata* and *P. muricata*.

Previously this taxon was included in *Arceuthobium occidentale* Engelm. (Hawksworth & Wiens, 1972, 1984). We now separate *A. littorum* as a distinct species parasitic on *Pinus radiata* D. Don, *P. muricata* D. Don, and rarely *P. contorta* Dougl. ex Loud. subsp. *bolanderi* (Parl.) Critch. It occurs from Fort Bragg (Mendocino County) to Cambria (San Luis Obispo County) and ranges in elevation from near sea level to about 250 m.

Arceuthobium littorum differs from *A. occiden-*

TABLE 3. Comparison of some characters of *Arceuthoblium littorum* and *A. occidentale*. Means are in parentheses.

Character	*A. littorum* (8 collections)	*A. occidentale* (9 collections)
Shoot height	10–20 (12) cm	6–12 (8) cm
Mean shoot diameter	2–5 (3.5) mm	1.5–4 (2.3) mm
Third internode	15 × 3.5 mm	12 × 2 mm
Shoot color	Dark brown to olive green	Light green to straw
Mature fruit length	4–5 mm	3.5–4.5 mm
Staminate flowers	4-partite	3- or 4-partite
Shoot habit	In dense globose clusters	Open, scattered shoots
Witches' brooms	Large, nonsystemic	Usually none
Peak anthesis	August–September (24 observations)	October–November (176 observations)
Peak seed dispersal	September–October (31 observations)	October–December (187 observations)
Mean fruit maturation	14 months	13 months
Elevational range	Near sea level to 250 m	100–1,200 m

tale in several features. *Arceuthobium occidentale* is primarily a parasite of *Pinus sabiniana* in the foothills surrounding the Central Valley of California. It is not sympatric with *A. littorum*, which is confined to a narrow band within about 5 km of the sea. Verticillate branching of *A. littorum* is somewhat more common than for *A. occidentale* (Mark & Hawksworth, 1981). Electrophoretic studies confirm that *A. littorum* is the most distinct member of the *A. campylopodum–A. occidentale* complex (Nickrent & Butler, 1990). Additional differences between *A. littorum* and *A. occidentale* are given in Table 3.

Pleistocene fossils of *A. littorum* (originally reported as *A. campylopodum*) were found associated with *P. muricata* and *P. radiata* in Marin County (Tomales Bay) and Santa Barbara County (Carpinteria and Santa Cruz Island) (Chaney & Mason, 1933). These 30,000–40,000-year-old populations are characterized by mostly 4-partite staminate flowers, a characteristic of modern *A. littorum*. This dwarf mistletoe is still extant near Tomales Bay, but is extinct at the other two localities.

Paratypes. U.S.A. CALIFORNIA: Alameda Co., Berkeley, on planted *P. radiata*, *Offord & Scharpf*, 1964 (FPF). Marin Co., Inverness Ridge, on *P. muricata*, *Howell 19686* (CAS, UC). Mendocino Co., Fort Bragg, on *P. muricata*, *Mason 5639* (UC); mouth of Gualala River, on *P. muricata*, *Bacigalupi 1808* (CAS); Van Damme State Park, on *P. muricata*, *Kuijt 1214* (UC); 2.9 mi. E of Point Arena, on *P. muricata*, *Nickrent 2719* (FPF, ILL); 2.7 mi. SE of Fort Bragg, on *P. contorta* subsp. *bolanderi*, *Nickrent 2716* (FPF, ILL); Van Damme State Park, on *P. contorta* subsp. *bolanderi*, *Kuijt 1215* (UC); just E of airport near Albion, on *P. contorta* subsp. *bolanderi*, *Peterson 65-116* (FPF); White Sands near Mendocino City, on *P. muricata*, *Eastwood 18836* (CAS); 2 mi. S of Anchor Cove, on *P. muricata*, *Wolf 1342* (CAS). Monterey Co., Pebble Beach, Carmel, on *P. radiata*, *Boyce 33* (FPF); Carmel, on *P. radiata*, *von Schrenk*, 1920 (MO); Carmel Highlands above Yankee Point, on *P. radiata*, *Balls 23608* (WTU); Point Lobos State Park, on *P. radiata*, *Lee & Mason 9153* (UC); Gibson Creek, on *P. radiata*, *Wheeler 4452* (POM); Monterey, on *P. radiata*, *Parry*, 1850 (MO); Pacific Grove, on *P. radiata*, *Davy 7064* (UC); Cypress Point, on *P. radiata*, *Abrams 7660* (RM, US); Huckleberry Hill, Carmel, on *P. muricata*, *Mason 5515* (UC). San Luis Obispo Co., Cambria, on *P. radiata*, *Gill FP68079* (FPF); between Cambria and Cambria Pines on Roberts road, on *P. radiata*, *Hawksworth 2264* (FPF). Sonoma Co., Fort Ross, on *P. muricata*, *Mason 4285* (UC); Kruse Rhododendron State Park on Rte. 1, on *P. muricata*, *Nickrent 2722* (FPF, ILL).

Arceuthobium tsugense (Rosendahl) G. N. Jones, Univ. Wash. Publ. Biol. 5: 139, 1936.

In our monograph (Hawksworth & Wiens, 1972), we commented on the unusually broad host range of *A. tsugense*, which not only encompassed both western species of *Tsuga*, but also several species of *Abies*, *Picea*, and *Pinus*. The occurrence of a form or "pathotype" (Hunt & Smith, 1978) on shore pine in British Columbia and the San Juan Islands of Washington had long been known (Hawksworth & Wiens, 1972; Hunt & Smith, 1978; Smith, 1971, 1974; Smith & Wass, 1976, 1979; Wass, 1976; Kuijt, 1956), although its taxonomic status has not been previously established. Field and laboratory studies of *A. tsugense* now show that this species is comprised of at least three segregates (Hawksworth, 1987; Mathiasen & Hawksworth, 1988).

The populations on mountain hemlock (subsp. *mertensianae*) and western hemlock (subsp. *tsugense*) are described here as subspecies because of

TABLE 4. Comparison of the shoot height of the two subspecies of *Arceuthobium tsugense*.

Subspecies	Number of collections	Shoot height	
		Range	Mean and standard error
subsp. *tsugense* (western hemlock race)	86	3–13 cm	6.9 ± 0.2 cm
subsp. *mertensianae*	58	3–9 cm	5.3 ± 0.2 cm

their distinct host ranges, shoot sizes, and marked isozyme differences (Nickrent, 1988; Nickrent & Stell, 1990). The populations of subspecies *tsugense* on western hemlock and shore pine are considered to be host races because they are morphologically and phenologically similar. Also, the isozyme patterns of the two races are similar, and they are sympatric in many stands (Nickrent & Stell, 1990).

Arceuthobium tsugense (Rosendahl) G. N. Jones subsp. **tsugense,** Univ. Wash. Publ. Biol. 5: 139, 1936.

As presently interpreted, this subspecies consists of two host races, one primarily on *Tsuga heterophylla* and one on *Pinus contorta* subsp. *contorta*. An intensive series of field and inoculation studies in British Columbia (Smith, 1971, 1974; Smith & Wass, 1976, 1979; Wass, 1976) showed that the two races are similar morphologically but differ in their host relationships. In inoculation tests, the *T. heterophylla* race produced very low infection levels on *P. contorta* subsp. *contorta*, but the few infections produced developed abundant aerial shoots. In contrast, the *P. contorta* subsp. *contorta* race produced a moderate infection level on *T. heterophylla*, but only a few of these produced aerial shoots (Smith & Wass, 1979). Maximum shoot height of the *T. heterophylla* race was about 30 percent taller than shoots of the *P. contorta* subsp. *contorta* race (Smith, 1971). Results from inoculation trials in two areas in British Columbia confirm the morphological similarity of the two races (E. Wass, pers. comm.). The only statistically significant difference between the populations in the two areas was that the fruits of the *P. contorta* subsp. *contorta* race were slightly longer and wider than those of the *T. heterophylla* race. Also, the peaks in anthesis and seed dispersal occurred about 10 days earlier in the *P. contorta* subsp. *contorta* race than in the *T. heterophylla* race in the same areas.

See Hawksworth & Wiens (1972) for information on the distribution of the two races. In general:

1. The western hemlock race is distributed from southeast Alaska (from near Haines, at nearly 60°N) throughout the coastal western hemlock forests of British Columbia, Washington, and Oregon to Humboldt and Del Norte counties in northwestern California (Hawksworth, 1987; Hawksworth & Wiens, 1972; Wood, 1986). Its principal host is *Tsuga heterophylla*. *Abies amabilis* and *A. procera* are frequently parasitized, but usually only where these trees are associated with infected *T. heterophylla*. This race is rare on associated *Tsuga mertensiana* and *Pinus monticola*. Inoculation tests have shown that several other trees from outside the natural range of western hemlock race are susceptible (Smith, 1965, 1970a, b, 1972, 1974; Smith & Craig, 1968; Smith & Wass, 1979; Weir, 1918). The western hemlock race is distributed from elevations near sea level in Alaska, British Columbia, Washington, Oregon, and California to about 1,200 m in southern Oregon.

2. The shore pine race is local in southern British Columbia (on the east shore of Vancouver Island and along the adjacent mainland coast) and on Orcas Island, Washington (Hawksworth, 1987; Smith & Wass, 1976; Wass, 1976). The northern limits of the race are poorly known. Two additional collections of a dwarf mistletoe on shore pine more than 450 km north of the main range of the shore pine race have been reported: at Port Clements on the Queen Charlotte Islands and at Terrace on the mainland (Wass, 1976). Studies of these populations are needed to determine whether they are indeed the shore pine race or merely rare crossovers of the western hemlock race. The principal host of the shore pine race is *Pinus contorta* subsp. *contorta*. It is usually rare on associated *Tsuga heterophylla*, but in some areas on Vancouver Island both trees are infected in mixed stands. Possibly these cases represent mixed populations of the two races. The shore pine race occasionally parasitizes associated *Pinus monticola* (Kuijt, 1956). Inoculation tests have shown that several other tree species from outside the natural range of the shore pine race are susceptible (Smith, 1970a, b, 1974; Smith & Craig, 1968; Smith & Wass, 1979). The shore pine race is distributed from about 100 to 800 m.

TABLE 5. Differential parasitism of selected hosts of the three segregates of *Arceuthobium tsugense*.

Taxon	*Tsuga heterophylla*	*Tsuga mertensiana*	*Pinus contorta* subsp. *contorta*	*Pinus monticola*
subsp. *tsugense*				
western hemlock race	Common	Very rare	Rare	Rare
shore pine race	Rare	*	Common	Rare
subsp. *mertensianae*	Immune	Common	*	Common

* Tree does not occur naturally within the range of the dwarf mistletoe.

Arceuthobium tsugense (Rosendahl) G. N. Jones subsp. **mertensianae** Hawksworth & Nickrent, subsp. nov. TYPE: U.S.A. Oregon: Douglas County, 16 mi. N of Union Creek on State Highway 230, on *Tsuga mertensiana*, elevation ca. 1,500 m, 2 Jan. 1990, *R. L. Mathiasen 9002* (holotype, US; isotypes, FPF, MO, ORE, OSC, UC, UWT).

Plantae 3–9 (5) cm altae; anthesis mense Augusto–Septembri; fructus maturitas mensis Septembri–Octobri. In *Tsugo mertensiana* parasiticae.

Plants similar to subspecies *tsugense* but are 3–9 (mean 5) cm tall; anthesis in August and September; fruits mature in September and October; parasite principally on *Tsuga mertensiana*.

The two subspecies are generally similar morphologically, but in subspecies *mertensianae* the shoots average about 30 percent shorter than in the western hemlock race of subspecies *tsugense* (Table 4). The differences are statistically highly significant ($t = 47.08$, $P = .0001$). We do not have sufficient material to make a comparable morphological analysis of the shore pine race of *A. tsugense*.

The phenology of flowering of the two subspecies is similar except that anthesis averages about 1 week earlier in the western hemlock race of subspecies *tsugense* (peak anthesis in August, with extremes from late July to late September, 56 observations) than for subspecies *mertensianae* (peak anthesis from mid-August to mid-September, 33 observations). The phenology data are based on observations throughout the range of the two taxa. In contrast to flowering, the seed dispersal period for subspecies *tsugense* (late September to early November, 57 observations) averages about 2 weeks *later* than for subspecies *mertensianae* (early September to late October, 31 observations), thus the fruit maturation period averages about 13 months in subspecies *tsugense* and 14 months for subspecies *mertensianae*.

Perhaps the marked differences in susceptibility of the two hemlocks to the two subspecies of the parasite is explained by the wide taxonomic differences of the two trees. For example, Page (1988) indicated that mountain hemlock is such a distinct entity that it should be segregated from *Tsuga* as a monotypic genus, *Hesperopeuce* Lemmon. If this classification is accepted, the scientific name for mountain hemlock becomes *Hesperopeuce mertensiana* (Bong.) Rydb. The two genera are said to differ in needle anatomy and morphology, shoot and cone morphology, bark features, and pollen morphology (Page, 1988). In another study, Farjon (1988) named the southern populations of *Tsuga mertensiana* as subspecies *grandicona* (the cones being 4–8 cm long, compared to 2–5 cm long for cones of the typical subspecies, *mertensiana*). All populations of *Tsuga mertensiana* from California and Nevada are referable to subspecies *grandicona*. The northern limits of this subspecies are not clear, but it ostensibly occurs as far north as the Siskiyou Mountains near the California–Oregon border. Thus, both subspecies are parasitized by *A. tsugense* subsp. *mertensianae*, but the mistletoe is much more common within the range of subspecies *grandicona*. In any case, the strong taxonomic differences between the two species of hemlock may help explain the unique host relations of the two subspecies of *A. tsugense*.

The three segregates of *A. tsugense* are most easily distinguished by their differential parasitism of *Tsuga heterophylla*, *Tsuga mertensiana*, *Pinus contorta* subsp. *contorta*, and *Pinus monticola* (Table 5). Further information on the host relationships of these mistletoes will be given in our revised monograph.

Arceuthobium tsugense subsp. *mertensianae* ranges from extreme southern British Columbia to the central Sierra Nevada in California, but it is most common from central Oregon southward. Its elevational range is from about 800 m in British Columbia to 2,500 m in central California. The northern limits of subspecies *mertensianae* have not been determined, but it occurs at least as far north as the Cypress Bowl area just north of Vancouver, British Columbia (Van Sickle & Fiddick, 1982). It is common at the Mt. Baker Ski Area in northern Washington. There are a number of collections, of

what is presumably this dwarf mistletoe, on the east side of the Cascade Mountains in Chelan County, Washington, but the distribution of the taxon there is poorly documented.

Arceuthobium tsugense subsp. *tsugense* rarely parasitizes *Tsuga mertensiana* in areas of Alaska where this tree is associated with infected *Tsuga heterophylla* (Shaw, 1982) and perhaps elsewhere.

The principal host of *A. tsugense* subsp. *mertensianae* is *Tsuga mertensiana*, and we have not found it parasitizing *Tsuga heterophylla*, even where this tree is closely associated with infected *T. mertensiana*. The mistletoe also parasitizes *Pinus monticola*, *P. albicaulis*, *Abies procera*, *A. amabilis*, and *A. lasiocarpa*, but usually only in areas where these trees are closely associated with infected *Tsuga mertensiana*.

Additional specimens examined: on *Tsuga mertensiana*, except as noted. U.S.A. CALIFORNIA: Alpine Co., Mosquito Lake, 11 mi. NE of Alpine, *Hawksworth & Scharpf 665* (FPF), and on *Pinus monticola*, *Hawksworth & Scharpf 666* (FPF). Placer Co., Emigrant Gap, *Jones*, 1881 (POM). Plumas Co., Mt. Elwell, *Lieberg 5363* (ILL, US); 0.4 mi. NE of Hawlsey Lake, *Mathiasen 8513* (FPF). Shasta Co., Lassen National Park, 2.5 mi. N of S entrance, *Wiens 3235* (COLO, FPF); 0.7 mi. E of Kings Creek Ground on Rte. 89, *Mathiasen 8511* (FPF). Sierra Co., Hawlsey Lake, 3 mi. W of Gold Lake, on *Pinus monticola*, *Mathiasen 8514* (FPF). Siskiyou Co., Marble Mtns., Kidder Creek, *Gill & Sargent FP68180* (FPF); Chimney Rock Lake, *Hemphill*, 1968 (FPF, UT) and on *Picea breweriana*, *Hemphill*, 1968 (FPF, UT); near Chimney Rock, on *Pinus monticola*, *Hemphill*, 1968 (FPF, UT); Little Marble Valley, *Mathiasen 8623* (FPF); Siskiyou Mtns., Applegate Creek Divide, *Meinecke FP97938* (PFRS) and on *Picea breweriana*, *Meinecke FP97941* (PFRS); N Slope of White Mtn., *Mathiasen 8629* (FPF), and on *P. monticola*, *Mathiasen 8628* (FPF); Trinity Alps, Snowslide Lake, *Mathiasen 9016* (FPF). Tehama Co., Mineral, *Lory FP97940* (PFRS). Trinity Co., 1–2 mi. S of Helen Lake, *Scharpf FP38027* (PFRS). OREGON: Clackamas Co., near Frog Lake, Wapinita Pass, *Mathiasen 8643* (FPF). Coos Co., Iron Mtn., *Baker*, 1946 (ID, OSC); 10 air mi. NNE of Agness, *Graham*, 1965 (FPF). Curry Co., Snow Camp Mtn., on *Pinus monticola*, *Nickrent & Wiens 2701* (FPF, ILL). Deschutes Co., 11 mi. W of Sisters on McKenzie Pass road, *Hawksworth & Hinds 991* (FPF), and on *Abies lasiocarpa*, *Hawksworth & Hinds 992* (FPF); 1 mi. W of Elk Lake near trail to Horse Lake, *Mathiasen 8645* (FPF). Douglas Co., just N of Crater Lake National Park on Diamond Lake road, *Graham*, 1964 (FPF); E side of Diamond Lake, 1 mi. N of jct. of Rtes. 230 & 138 on 138, *Mathiasen 8616* (FPF); 4 mi. SW of Windigo Pass on Lemolo Lake road, *Hawksworth 2339* (FPF), and on *Pinus monticola*, *Hawksworth 2340* (FPF). Jackson Co., Union Creek, *Applegate 6038* (CAS); Huckleberry Mtn., 10 mi. NE of Prospect, *Graham*, 1965 (FPF). Klamath Co., Crater Lake National Park, Annie Springs, *Gill FP68184* (FPF); Wineglass, on *Pinus albicaulis*, *Gill FP68182* (FPF); 5 mi. E of main road on N rim of Crater Lake, *Hawksworth & Wiens 624* (FPF), and on *Pinus albicaulis*, *Hawksworth & Wiens 625* (FPF); 2 mi. N of Windigo Pass, *Hawksworth & Wiens 621* (FPF) and on *Pinus monticola*, *Hawksworth & Wiens 622* (FPF); 8 air mi. N of Lake of the Woods on Cold Springs road, *Hawksworth 2375* (FPF). Lane Co., McKenzie Pass, on *Pinus albicaulis*, *Gill FP68188* (FPF). Linn Co., Minto Mtn., *Mielke FP40694* (OSC); Marion Lake, *Coville & Applegate 1156* (US); Wildcat Mtn., *Hawksworth 2358* (FPF), on *Abies amabilis*, *Hawksworth 2355* (FPF), and on *Abies procera*, *Hawksworth 2356* (FPF); H. J. Andrews Experimental Forest, near Frissell Point, *Hawksworth 2359* (FPF), on *Abies amabilis*, *Hawksworth 2360* (FPF), and on *Abies procera*, *Hawksworth 2361* (FPF). WASHINGTON: Whatcom Co., Mt. Baker Ski Area, *Mathiasen 9005* (FPF), and on *Abies amabilis*, *Mathiasen 9006* (FPF); Twin Sister Range, *Meunschler 10431* (CAS). Chelan Co., Lyman Glacier W of Lucerne, *Weir 2456* (ILL). Pierce Co., Upper Nisqually Valley, *Allen 303* (CAS, MO, UT). CANADA. BRITISH COLUMBIA: Cypress Bowl Park, Hollyburn rd., *Wood*, 1982 (DAVFP); Lost Lake, Brothers Creek, adjacent to Cypress Bowl Park, *Alexander*, 1972 (DAVFP).

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New Combinations in *Stigmatodactylus* (Orchidaceae)

Paul Kores
Ecology, Evolution, and Organismal Biology Department, Tulane University,
New Orleans, Louisiana 70118, U.S.A.

ABSTRACT. Recent anatomical and morphological studies of the Acianthinae indicate that the four species of *Acianthus* from Papuasia are better placed within *Stigmatodactylus*. This transfer requires three new combinations.

Stigmatodactylus Maxim. ex Makino is a small genus of ground orchids that was established in Makino's (1891) *Illustrations of the Flora of Japan*. As currently delimited, it contains approximately seven species and is found in Japan, northern India, Java, Borneo, the Celebes, the Moluccas, New Guinea, and the Solomon Islands (Bougainville and Guadalcanal). The genus is closely allied to *Acianthus* R. Br. and *Townsonia* Cheesm., but is readily distinguished from these genera by its massive, subentire or 3-lobed basal callus on the labellum, ventrally keeled or appendaged column, and prominent dactyliform appendage on the posterior margin of the stigma. In addition, *Stigmatodactylus* has axillary subterranean tubers (as opposed to terminal ones in *Acianthus*); the plants are unifoliate (as opposed to multifoliate in *Townsonia*); and the cells that line the anther have type IV endothecial thickenings (Freudenstein, 1991) (as opposed to type I or type IIIc thickenings in *Acianthus* or type I thickenings in *Townsonia*).

After examining these genera in detail, I have concluded that the three species I previously described from Papuasia (Kores, 1991) are incorrectly placed within *Acianthus* and should be transferred to *Stigmatodactylus*. New combinations are here proposed for the three species not previously transferred to *Stigmatodactylus*. It should also be noted that with the exclusion of the Papuasian taxa from *Acianthus*, the geographic distribution of the genus is restricted to New Caledonia, New Zealand, and Australia.

Stigmatodactylus gibbsae (Kores) Kores, comb. nov. Basionym: *Acianthus gibbsae* Kores in Lindleyana, 6: 166, f. 2. 1991.

Stigmatodactylus croftianus (Kores) Kores, comb. nov. Basionym: *Acianthus croftianus* Kores in Lindleyana, 6: 168, f. 3. 1991.

Stigmatodactylus variegatus (Kores) Kores, comb. nov. Basionym: *Acianthus variegatus* Kores in Lindleyana, 6: 171, f. 4. 1991.

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NOVON 2: 212. 1992.

New Combinations in Californian *Lessingia* (Compositae: Astereae)

Meredith A. Lane
R. L. McGregor Herbarium and Department of Botany, University of Kansas, Lawrence, Kansas 66047, U.S.A.

ABSTRACT. As treated for the forthcoming revision of the Jepson *Manual of the Flowering Plants of California*, there are 14 species of *Lessingia* Cham. in California. *Benitoa* Keck and *Corethrogyne* DC. are considered to be congeneric with *Lessingia*.

A forthcoming publication will provide more supporting data for the transfer of *Benitoa occidentalis* (H. M. Hall) Keck, *Corethrogyne filaginifolia* (Hook. & Arn.) Nutt., and *C. californica* DC. into *Lessingia* Cham., and discuss the treatment of *Lessingia* by Spence (1963). However, new combinations to accommodate these three taxa in *Lessingia* are needed for the revision of the Jepson *Manual of the Flowering Plants of California*. A brief justification for these transfers follows.

Benitoa Keck has an annual habit, turbinate involucres, and disk corollas that are funnelform, yellow tinged with deep purple-red, and deeply lobed, and style-branch appendages that are linear; it shares these characters with several undisputed species of *Lessingia* (Howell, 1929; Spence, 1963). *Benitoa* is monotypic, and is found on serpentine-derived soils in southern San Benito, southwestern Fresno, and southeastern Monterey counties (Keck, 1956). Though *Benitoa* can be a much larger plant than most lessingias, in branching pattern, leaf morphology, pubescence, and glandularity it is very similar to them.

Corethrogyne DC. taxa have a perennial herbaceous habit, turbinate to hemispheric involucres, disk corollas that are linear, yellow, and shallowly lobed, and style-branch appendages that are tufted; they share these characters with several other undisputed species of *Lessingia* (Spence, 1963). *Corethrogyne* has been treated as having various numbers of taxa (Canby, 1927; Howell, 1929; Keck, 1959), because it is extremely variable both within and between populations. Here it is treated as having a single species with two highly polymorphic varieties, based on an unpublished revision of *Corethrogyne* by J. P. Saroyan, D. R. Parnell, and J. L. Strother. The range of variation in vestiture of the foliage, the capitulescence, and the shape of the involucres of *Corethrogyne* taxa is all encompassed by that of *Lessingia*.

The three genera have been maintained in the past because taxa of *Lessingia* sensu stricto are all eradiate and the others have ray florets, and because the rays of *Benitoa* are yellow while those of *Corethrogyne* are purple. The presence or absence of ray florets is probably only a single-gene character (Jackson & Dimas, 1981; Gottlieb, 1984). Given that species of *Lessingia* have yellow, white, pink, or purple disk corollas, it does not seem logical to use corolla color as a generic marker. Also, the members of all three genera have phyllaries with resin-canals and (usually) gland-tipped apices, obconic, trinerved, mottled achenes with a pappus of several (late-)deciduous bristles, and chromosome numbers of $n = 5$. In addition, they share at least 20 unique restriction site mutations (and differ among themselves in none) found among 63 taxa of Astereae in a chloroplast DNA study using 17 enzymes (M. Lane, unpublished data).

Lessingia filaginifolia (Hook. & Arn.) M. A. Lane, comb. nov. Basionym: *Aster ? filaginifolius* Hook. & Arn., Bot. Beech. Voy. 146. 1833. *Corethrogyne californica* DC. [var.] *filaginifolia* (Hook. & Arn.) Kuntze, Rev. Gen. Pl. 1: 330. 1891, illegit. TYPE: U.S.A. [California]: presumably *Lay and/or Collie s.n.* (Beechey voyage) (holotype, E fide Saroyan et al.).

Kuntze's combination is illegitimate because its basionym, *Aster filaginifolius*, is older than *Corethrogyne californica*.

Lessingia filaginifolia (Hook. & Arn.) M. A. Lane var. **californica** (DC.) M. A. Lane, comb. et stat. nov. Basionym: *Corethrogyne californica* DC., Prodr. 5: 215, 1836. TYPE: "Nova California," *Douglas*, 1833 (holotype, G-DC fide Saroyan et al.; isotypes, BM, K fide Saroyan et al.; microfiche, KANU).

Lessingia occidentalis (H. M. Hall) M. A. Lane, comb. nov. Basionym: *Haplopappus occidentalis* H. M. Hall, Carnegie Inst. Wash. Publ. 389: 214. 1928. *Benitoa occidentalis* (H. M. Hall) Keck, Leafl. W. Bot. 8: 25–40. 1956.

TYPE: U.S.A. California: Fresno Co., E side of summit of Parkfield Grade, *Hall 11769* (holotype, UC).

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New Combinations in Californian *Grindelia* (Compositae: Astereae)

Meredith A. Lane
R. L. McGregor Herbarium and Department of Botany, University of Kansas,
Lawrence, Kansas 66047, U.S.A.

ABSTRACT. As treated for the forthcoming revision of the Jepson *Manual of the Flowering Plants of California*, there are six species of *Grindelia* in California. Hybridization among them is common, and is apparently the reason for proliferation of epithets in the group. Thorough study of over 6,000 specimens (including the types for all epithets involved) from 34 herbaria has necessitated the recognition of several new combinations, and synonymization of many others.

Grindelia Willd. (Compositae: Astereae) is even more highly variable in California than elsewhere in its range in the western United States, Mexico, and South America. Several of the taxa apparently hybridize freely when they are in contact; this is the primary source of the taxonomic confusion that has led to the erection of more than 60 epithets for taxa of California alone. Though a more thorough discussion of the systematics of this group will be published elsewhere, it is necessary now to provide new combinations that may be used in a treatment of *Grindelia* for the forthcoming revision of the Jepson *Manual of the Flowering Plants of California*. Based on examination of the types for all the basionyms involved and over 6,000 specimens from 34 herbaria, I have come to the conclusion that it is most reasonable to recognize six species for the state.

One of these, *Grindelia squarrosa* (Pursh) Dunal, represented in California by *G. squarrosa* var. *serrulata* (Rydberg) Steyermark, is probably adventive, and occurs in only a few localities. It is not a major player in the hybridization reticula, and is easily distinguished from other California specimens by its bluntly dentate-serrulate leaf margins.

Another species, *Grindelia fraxino-pratensis* Reveal & Beatley, is known only from the Ash Meadows area of Nye Co., Nevada, and Inyo Co., California, and is not involved in hybridizations with other taxa. The involucres of *G. fraxino-pratensis* are broadly turbinate; all other grindelias in California have broadly campanulate to hemispheric heads.

Grindelia nana Nutt. is found in northeastern California, and though it is variable and probably participates in hybridizations with other taxa, the nomenclatural situation surrounding it (in California, at least) is straightforward. Steyermark (1934: 541–546) treated it as having three varieties in California; I agree with Keck (1959: 1166) that there are insufficient characters for such subdivision of the taxon. Plants of this species may be recognized by the tightly coiled phyllaries, coppery-red stems, and sharply serrate leaves.

The remaining three species have been treated differently by each worker who has encountered them, and for that reason synonymies for each new and recognized combination are included here. I have adopted a broad species-concept, accepting a wide range of variability for each species; geographical components of the variability have been recognized at the varietal level. The characters that distinguish the taxa are few enough and intergrade sufficiently that the recognition of more taxa than those listed below is unwarranted. Combinations that have been applied to California specimens of *Grindelia* but that do not appear in the lists of synonyms below represent hybrids, and cannot legitimately be assigned as synonyms to either of the parent taxa.

Grindelia stricta DC. and its varieties are coastal in distribution and are found on beaches and at the edges of marshes and sloughs. They have very robust pappus awns (> 0.3 mm wide at base) that are generally V-shaped in cross section, and the leaves are usually more or less succulent. The varieties are distinguished by habit of the plant and shape of the leaves. The other two species have slender pappus members (< 0.3 mm wide) and are mostly found inland. *Grindelia camporum* E. Greene and its variety have stiff phyllaries usually with reflexed apices, mostly white to buff-colored stems and light green, very resinous leaves, and are found in the San Francisco Bay area, the Great Valley, and the lower foothills of the Sierra Nevada. *Grindelia hirsutula* Hook. & Arn. and its varieties usually have somewhat flexible phyllaries with ascendant to reflexed apices, coppery-buff to deep red-brown stems, and leaves that are variously invested but not highly resinous; they are found in the San Francisco Bay area and the Coast Ranges.

NOVON 2: 215–217. 1992.

Grindelia camporum E. Greene, Man. Bot. S. F. Bay Reg. 171. 1894. TYPE: U.S.A. California: Antioch, *Greene*, 1881 (lectotype, MO, selected here).

Grindelia robusta Nutt. var. (?) *rigida* A. Gray, Geol. Surv. Cal. Bot. 1: 304. 1876. TYPE: U.S.A. California: (holotype, GH).

Grindelia procera E. Greene, Man. Bot. S. F. Bay Reg. 171. 1894. TYPE: U.S.A. California: San Joaquin Co., Banta, *Bioletti*, 1892 (lectotype, selected here, UC). [Contrary to Howell (1931), I agree with Jepson (1901) that this is a synonym of *G. camporum*.]

Grindelia camporum E. Greene var. *parviflora* Steyermark, Ann. Missouri Bot. Gard. 21: 534. 1934. TYPE: U.S.A. California: Contra Costa Co., Liberty School on Marsh Creek road, *Howell 5496* (holotype, CAS; isotypes, GH, IND not seen, MO).

Grindelia camporum E. Greene var. *abbreviata* Steyermark, Ann. Missouri Bot. Gard. 21: 228. 1934. TYPE: U.S.A. California: Los Angeles Co., Lancaster, *Hoffmann*, 1927 (holotype, SBBG; photograph, MO).

Grindelia camporum E. Greene var. *australis* Steyermark, Ann. Missouri Bot. Gard. 21: 228. 1934. TYPE: U.S.A. California: Los Angeles Co., 3 mi. E of Elizabeth Lake, *Munz & Johnston 11157* (holotype, POM; isotype, LL; photograph, MO).

Grindelia camporum E. Greene var. **bracteosa** (J. Howell) M. A. Lane, comb. nov. Basionym: *Grindelia bracteosa* J. Howell, Madroño 2: 22. 1931. *G. rubricaulis* DC. var. *bracteosa* (J. Howell) Steyermark, Ann. Missouri Bot. Gard. 21: 227. 1934. *G. robusta* Nutt. var. *bracteosa* (J. Howell) Keck, Aliso 4: 102. 1958. TYPE: U.S.A. California: Orange Co., N side of Santa Ana Canyon, *J. Howell 2786* (holotype, CAS; isotypes, CAS, MO, RSA; photographs, F, GH, US).

Grindelia rubricaulis DC. var. *elata* Steyermark, Ann. Missouri Bot. Gard. 21: 227. 1934. Syn. nov. TYPE: U.S.A. California: Ventura Co., 7 mi. SW of Simi, *J. Howell 6574* (holotype, CAS; photograph, MO).

Grindelia hirsutula Hook. & Arn., Bot. Beech. Voy. 147. 1833. TYPE: U.S.A. California: in vicinity either of Monterey or of San Francisco Bay (A. Gray in Geol. Surv. Cal. Bot. 1: 304. 1876), *Lay and/or Collie s.n.* (holotype, E; isotype, K; photographs, GH, UC).

Grindelia humilis Hook. & Arn., Bot. Beech. Voy. 147. 1833. Syn. nov. TYPE: U.S.A. California: in vicinity either of Monterey or of San Francisco Bay (A. Gray in Geol. Surv. Cal. Bot. 1: 304. 1876), *Lay and/or Collie s.n.* (holotype, E not seen; isotype, K; fragments, CAS, GH; photographs, GH, US). [In the past, this name consistently has been misapplied, based on a misinterpretation of the type; however, the type is clearly conspecific with *G. hirsutula*. The plant that has been called *G. humilis* is *G. stricta* var. *angustifolia*.]

Grindelia rubricaulis DC., Prod. 5: 316. 1836. Syn. nov. *G. hirsutula* Hook. & Arn. subsp. *rubricaulis* (DC.) Keck, Aliso 4: 102. 1958. TYPE: U.S.A. California: *Douglas 55* (holotype, G-DC; isotypes, BM, K; fragment, GH; photographs, GH, MO, UC).

Grindelia pacifica M. E. Jones, Bull. Torrey Bot. Club 9: 31. 1882. TYPE: U.S.A. California: Santa Cruz Co., Santa Cruz, *M. E. Jones 2750* (holotype, POM; isotypes, GH, NY).

Grindelia hirsutula Hook. & Arn. var. *subintegra* Steyermark, Ann. Missouri Bot. Gard. 21: 229. 1934. TYPE: U.S.A. California: Ventura Co., 2 mi. E of Ojai, *J. Howell 11414* (holotype, MO; isotypes, CAS—2, F, GH, K, LL, NY).

Grindelia hirsutula Hook. & Arn. var. *brevisquama* Steyermark, Ann. Missouri Bot. Gard. 21: 572. 1934. TYPE: U.S.A. California: Sonoma Co., Black Point Road, *J. Howell 5338* (holotype, CAS; isotype, UC; photograph, MO).

Grindelia hirsutula Hook. & Arn. var. *calva* Steyermark, Ann. Missouri Bot. Gard. 21: 575. 1934. TYPE: U.S.A. California: San Luis Obispo Co., San Luis Obispo, *Roadhouse 65* (holotype, UC; photograph, MO).

Grindelia hirsutula Hook. & Arn. var. **davyi** (Jepson) M. A. Lane, comb. nov. Basionym: *G. robusta* Nutt. var. *davyi* Jepson, Fl. W. Mid. Cal. 554. 1901. *G. camporum* E. Greene var. *davyi* (Jepson) Steyermark, Ann. Missouri Bot. Gard. 21: 534. 1934. TYPE: U.S.A. California: Alameda Co., Berkeley, Peralta Park, *Davy*, 1896 (holotype, JEPS; isotypes, UC—2; photographs, F—3, GH—2, MO).

Grindelia rubricaulis DC. var. *interioris* Jepson, Man. Fl. Pl. Cal. 1021. 1925. *G. camporum* E. Greene var. *interioris* (Jepson) Steyermark, Ann. Missouri Bot. Gard. 21: 534. 1934. TYPE: U.S.A. California: Calaveras Co., Copperopolis, *Davy 1383* (holotype, UC; photograph, F).

Grindelia hirsutula Hook. & Arn. var. **hallii** (Steyermark) M. A. Lane, comb. nov. Basionym: *G. hallii* Steyermark, Ann. Missouri Bot. Gard. 21: 229. 1934. TYPE: U.S.A. California: San Diego Co., Cuyamaca Lake, *Abrams 3957* (holotype, NY; isotypes, CAS, E, F, GH, K, MO, POM).

Grindelia hirsutula Hook. & Arn. var. **maritima** (E. Greene) M. A. Lane, comb. nov. Basionym: *G. rubricaulis* DC. var. *maritima* E. Greene. Pittonia 2: 289. 1892. *G. robusta* Nutt. var. *maritima* (E. Greene) Jepson, Fl. W. Mid. Cal. 554. 1901. *G. maritima* (E. Greene) Steyermark, Ann. Missouri Bot. Gard. 21: 576. 1934. TYPE: U.S.A. California: San

Francisco Co., Point Lobos, *E. Greene*, 1892 (holotype, ND-G; isotype, UC).

Grindelia stricta DC., Prod. 7: 28. 1838. TYPE: "in America boreali-occid., ad portum Mulgrave," *Haenke s.n.* (holotype, G-DC not seen; photographs, CAS, GH, UC).

Grindelia blakei Steyermark, Ann. Missouri Bot. Gard. 21: 567. 1934. *G. stricta* DC. subsp. *blakei* (Steyermark) Keck, Aliso 4: 102. 1958. TYPE: U.S.A. California: Humboldt Co., Eureka, *Moore & Steyermark 3686* (holotype, MO; isotypes, MO, UC).

Grindelia stricta DC. var. **angustifolia** (A. Gray) M. A. Lane, comb. nov. Basionym: *G. robusta* Nutt. var. *angustifolia* A. Gray, Geol. Surv. Cal. Bot. 1: 304. 1876, as nom. nov. for *G. cuneifolia* Nutt., Trans. Amer. Philos. Soc. n.s. 7: 315. 1841. TYPE: U.S.A. California: Santa Barbara Co., Santa Barbara, *Nuttall s.n.* (holotype, PH not seen; isotype, BM; fragment, GH). [The type of *Grindelia robusta* Nutt. is a hybrid between *G. hirsutula* var. *hirsutula* and another variety of *G. stricta;* therefore, the autonym does not take precedence.]

Grindelia stricta DC. var. **platyphylla** (E. Greene) M. A. Lane, comb. nov. Basionym: *G. robusta* var. *platyphylla* E. Greene, Pittonia 2: 289. 1892. *G. rubricaulis* DC. var. *platyphylla* (E. Greene) Steyermark, Ann. Missouri Bot. Gard. 21: 227. 1934. *G. latifolia* Kellogg subsp. *platyphylla* (E. Greene) Keck, Aliso 4: 102. 1958. TYPE: U.S.A. California: Monterey Co., Monterey, *Howe*, 1892 (holotype, UC; isotype, UC; photograph, MO).

Grindelia arenicola Steyermark, Ann. Missouri Bot. Gard. 21: 229. 1934. TYPE: U.S.A. California: Mendocino Co., 4.5 mi. N of Fort Bragg, *Howell 5473* (holotype, CAS; isotypes, GH, MO, POM, UC).

Grindelia arenicola Steyermark var. *pachyphylla* Steyermark, Ann. Missouri Bot. Gard. 21: 596. 1934. TYPE: U.S.A. California: Mendocino Co., Point Arena, *Howell 8106* (holotype, CAS; isotypes, GH, MO).

Grindelia stricta DC. var. *procumbens* Steyermark, Ann. Missouri Bot. Gard. 21: 559. 1934. TYPE: U.S.A. California: Humboldt Co., 10 mi. N of Trinidad, *Moore & Steyermark 3687* (holotype, MO; isotype, MO).

Grindelia venulosa Jepson, Man. Fl. Pl. Calif. 1021. 1925. *G. stricta* DC. subsp. *venulosa* (Jepson) Keck, Aliso 4: 102. 1958. TYPE: U.S.A. California: Humboldt Co., Big Flat, *Bolander 6493* (holotype, JEPS; isotypes, K, US; photograph, F).

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Steyermark, J. A. 1934. Studies in *Grindelia.* II. Ann. Missouri. Bot. Gard. 21: 434–608.

Antiostelma (Asclepiadaceae), a New Genus from China

Li Ping-tao
South China Agricultural University, Guangzhou 510642, Guangdong,
People's Republic of China

ABSTRACT. *Antiostelma* (Asclepiadaceae), previously recognized as a section of *Hoya*, is raised to generic rank. The new combinations *Antiostelma lantsangense* (Tsiang & P. T. Li) P. T. Li and *A. manipurense* (D. B. Deb) P. T. Li are proposed.

As a result of recent study of Chinese material of Asclepiadaceae and Apocynaceae from the Missouri Botanical Garden, the Smithsonian Institution, Harvard University, and the California Academy of Sciences, and during preparation of the accounts of these families for the *Flora of China*, it became evident that the delimitation of certain genera needed critical study, and several nomenclatural adjustments needed to be made. This publication deals with a new genus of Asclepiadaceae, *Antiostelma*. It was originally described as a monotypic section of *Hoya* R. Br. The new combinations are proposed in order to make the names available for the *Flora of China* and other floristic works in progress.

Antiostelma (Tsiang & P. T. Li) P. T. Li, comb. et stat. nov. Basionym: *Hoya* sect. *Antiostelma* Tsiang & P. T. Li, Acta Phytotax. Sin. 12: 126. 1974. TYPE: *Antiostelma lantsangensis* (Tsiang & P. T. Li) P. T. Li.

Lacticiferous epiphytic subshrubs. Leaves opposite, obdeltoid or obovate. Cymes extra-axillary, umbellate, subsessile or sessile. Calyx eglandular inside; corolla cylindric, lobes erect, aestivation twisted leftward; corona lobes 5, fleshy, erect, quadrate, adnate adaxially to gynostegium, bilateral margin manifestly recurved at back; stamens 5, anthers erect, with acuminate apical membranes; pollinia subquadrate, basal margin translucent; ovaries free; style apex beaked, exceeding apical membrane of anthers. Follicles linear-lanceolate. Seeds comose.

Antiostelma includes two species, *A. lantsangensis* and *A. manipurense*, that are endemic to China and India, respectively. The genus was originally recognized as a section of *Hoya* R. Br. (Tsiang & Li, 1974, 1977), but critical examination of several collections reveal that it is best treated as an independent genus readily distinguished from *Hoya* and *Dischidia* by the several characters summarized in Table 1.

The two species of *Antiostelma* are easily distinguished by the following key.

1a. Branches and leaves glabrous; leaf apex retuse; China ..... *A. lantsangense*
1b. Branches and leaves densely pubescent; leaf apex truncate; India ..... *A. manipurense*

Antiostelma lantsangense (Tsiang & P. T. Li) P. T. Li, comb. nov. Basionym: *Hoya lantsangensis* Tsiang & P. T. Li, Acta Phytotax. Sin. 12: 126. 1974. TYPE: China. Yunnan:

TABLE 1. Comparison of *Antiostelma*, *Hoya*, and *Dischidia*.

	Antiostelma	*Hoya*	*Dischidia*
Corolla	cylindric	rotate	urceolate
Aestivation	twisted leftward	valvate	valvate
Corolla lobes	erect, much shorter than tube	reflexed, as long as or longer than tube	patent, shorter than tube
Corona lobes	erect, quadrate	stellate-patent, ovate or elliptic	erect, anchor-shaped
Caudicle	not dilated	not dilated	apex dilated
Style apex	exserted from apical anther membranes	included in apical anther membranes	included in apical anther membranes
Inflorescence	sessile or subsessile	long-peduncled	short-peduncled

Mo-Jiang, 1,000 m, *A. Henry 13689* (holotype, NY; isotype, IBSC).

Antiostelma manipurense (D. B. Deb) P. T. Li, comb. nov. Basionym: *Hoya manipurensis* D. B. Deb, J. Indian Bot. Soc. 34: 50. 1955. TYPE: India. Manipur, Litan, 1 Sep. 1953, *D. B. Deb 1081* (holotype, CAL).

Acknowledgments. I am grateful to Peter H. Raven, William Tai, W. Douglas Stevens, Laurence Skog, Dan Nicholson, and David Boufford for their support of my visit to the United States. I am also grateful to Ihsan Al-Shehbaz for help with the manuscript.

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Note Added in Proof

M. Gilbert (MO) recently brought to our attention the fact that Maxwell & van Donkelaar (Nat. Hist. Bull. Siam Soc. 39: 78. 1991) have treated, with scant discussion, *Hoya lantsangensis* as a synonym of *Dischidia obcordata* and thus, by implication, *Hoya* sect. *Antiostelma*, which was termed "an erroneous and quite unnecessary taxonomic complication," as a synonym of *Dischidia*. — *Editor*

Cynanchum wangii (Asclepiadaceae), a New Species from China

Li Ping-tao
South China Agricultural University, Guangzhou 510642, Guangdong,
People's Republic of China

Walter Kittredge
Harvard University Herbaria, 22 Divinity Avenue, Cambridge,
Massachusetts 02138, U.S.A.

ABSTRACT. *Cynanchum wangii*, a new species from Yunnan, China, is described, and a photograph of the type specimen is given.

Cynanchum is a genus of about 200 species, of which 53 species and 12 varieties were recognized in China by Tsiang & Li (1977). With the addition of five other species by P. T. Li (1983, 1990) and *C. wangii*, the total number of species of *Cynanchum* in China is now 59. The genus is difficult taxonomically, and D. Z. Li (1990) and Qiu (1989) have treated it as several segregate genera. However, most Chinese taxonomists (e.g., Tsiang & Li, 1977; P. T. Li, 1991) agree that the larger concept represents a natural genus.

Cynanchum wangii P. T. Li & Kittredge, sp. nov. TYPE: China. Yunnan: Meng-Nun, Jenn-Yeh Hsien, 750 m, riverbank, Nov. 1936, *C. W. Wang 80897* (holotype, A; isotypes, IBSC, KUN, PE). Figure 1.

Herba perennis erecta 10–20 cm alta; caule ramoso puberulo. Folia linearia glabra, 5–20 × 1–2 mm. Cymae 3–7-florae, extra-axillares vel terminales; pedunculis gracilibus 3–8 cm longis, puberulis. Flores calyx intus as bases sinuum 5-glandulifero, lobis ovato-triangularibus, glabris, ca. 0.5 × 0.5 mm; corolla viridi-flava, rotata, extus glabra, intus dense pubescente; corona applanata ad dorsum gynostegii adnata gynostemio breviore 5-partita, lobis semiorbiculatis, ca. 0.5 × 0.5 mm; staminibus stigma aequantibus, antheris oblongis membranaceis, connectivis orbiculatis, polliniis longe ovoideis, pendulis, retinaculo oblongo, caudicula brevissima; ovariis glabris, stigmate basi discoideo-pentagono; ovulis numerosis.

Erect perennial herbs 10–20 cm tall; stem many-branched, ca. 1 mm diam.; uniformly puberulous, internodes 0.8–3.5 cm long; branchlets delicate, puberulous. Leaves opposite, linear, 5–20 × 1–2 mm, glabrous, base cuneate, apex rounded or obtuse; midrib flat on both surfaces, lateral veins obscure. Cymes umbelliform or corymbose, 3- to 7-flowered, extra-axillary or terminal, solitary; peduncles delicate, 3–8 cm long, puberulous; pedicels 4–7 mm long. Calyx with 5 basal glands inside, calyx lobes ovate-triangular, 0.5 × 0.5 mm, glabrous; corolla greenish yellow, rotate, membranous, tube ca. 1 mm, glabrous, lobes oblong-lanceolate, ca. 4 mm long, 1 mm wide, glabrous outside, densely pubescent inside; outer corona absent, inner one inserted at base of gynostegium, 5-partite, lobes semiorbicular, 0.5 × 0.5 mm, erect, somewhat fleshy, apex rounded, nearly half as long as anther membrane; anthers oblong, apical membrane rounded, as high as stigma; pollinia oblong-ovoid, pendulous, retinaculum oblong, caudicle very short; ovaries long-ovoid, glabrous; stigma pentagonal-disklike; apex slightly elevated; ovules numerous in each carpel.

Flowering May through August, fruiting October through November; grows along riverbanks at altitudes of ca. 700–900 m.

Paratypes. CHINA. YUNNAN: Mong-Hain, Gan-Lan-Ba, Ching-Hung Hsien, *Wang 79920* (A); Lann-Tsang Hsien, *Wang 76710* (A).

Cynanchum wangii, which is so far only known from three collections, is most closely related to *C. stenophyllum* Hemsley, a species distributed in Hubei and Guizhou provinces, China. It is readily distinguished from the latter by its small, slender leaves 1–2 mm wide, umbellate or corymbose inflorescences longer than leaves, greenish yellow flowers, oblong-lanceolate corolla lobes, and 5-partite corona nearly half as long as the anther membrane.

Acknowledgments. We are grateful to David E. Boufford, Bryan Dutton, and Ihsan Al-Shehbaz for help with the manuscript. Thanks also to Roy Gereau for checking the Latin.

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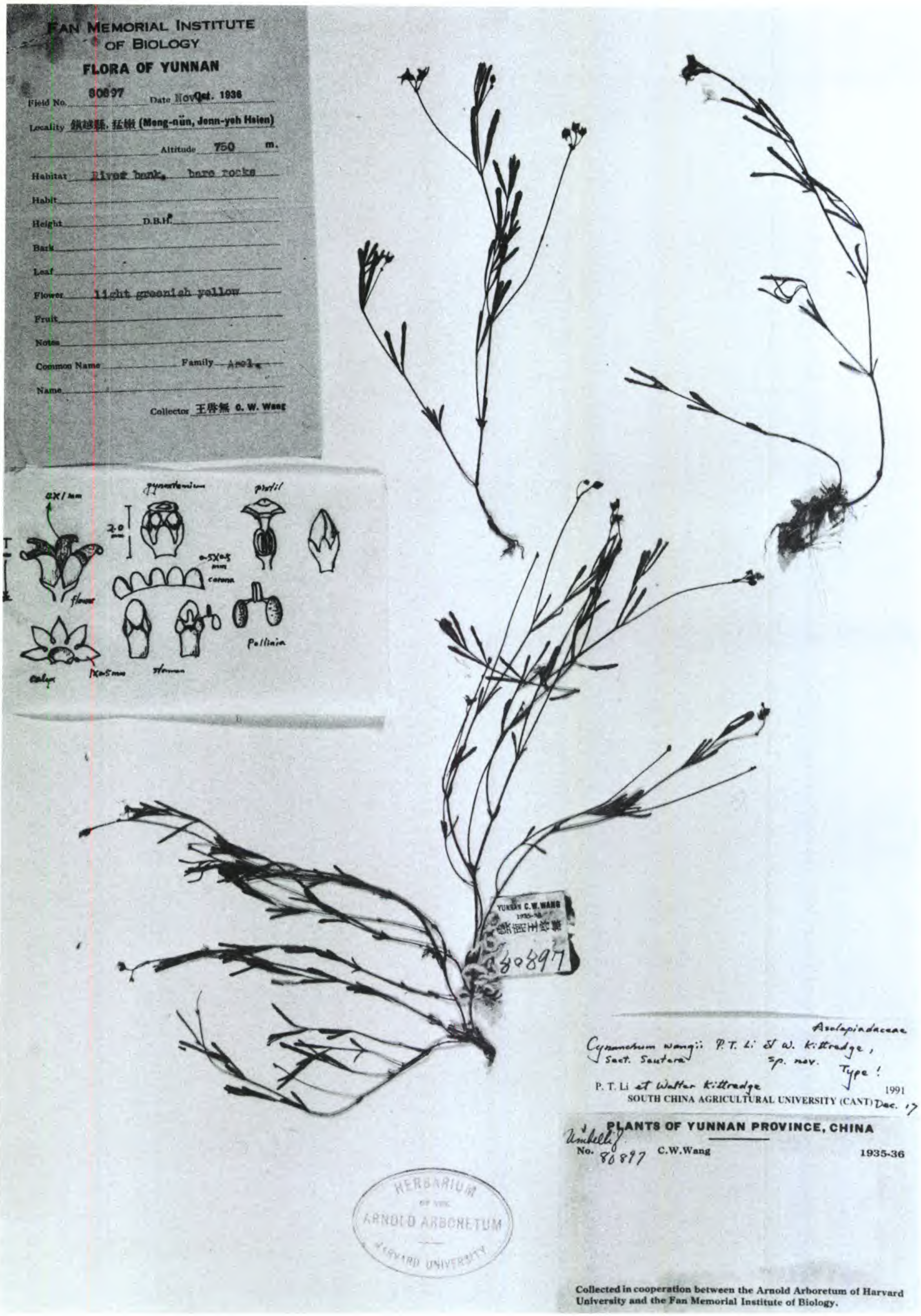

Figure 1. *Cynanchum wangii* P. T. Li & Kittredge, *C. W. Wang 80897* (holotype, A).

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A New Species of *Sarcostemma* (Asclepiadaceae) from Malawi

Sigrid Liede and Ulrich Meve

Institut für Botanik, Schlossgarten 3, W-4400 Münster, Germany; Liede's present address: Abteilung Spezielle Botanik (Biologie V), Albert-Einstein-Allee II, W-7900 Ulm, Germany

ABSTRACT. A new species of Old World *Sarcostemma*, *Sarcostemma mulanjense* from Malawi, is described.

Sarcostemma viminale (L.) R. Br. and its allies are widespread throughout the arid areas of the Old World. Because dried specimens rarely show such key characters as habit, morphology of the stem base, and floral color, the group is taxonomically difficult and still lacks a clear-cut concept applicable over its entire range. However, field-based studies in more limited areas have resulted in the distinction of several closely related species and subspecies (Adams & Holland, 1978a, b, for East Africa; Forster, 1988, for Australia). Recent fieldwork in Malawi has resulted in the discovery of a new, clearly delimited species endemic to the southern Malawi mountains.

Specimens have been studied from BM, MO, and NU. Fieldwork in Malawi (by S. Liede) has yielded living material, cultivated at the Institut für Botanik, Münster (Germany), Kenyatta University, Nairobi (Kenya), and the National Botanic Gardens, Kirstenbosch (South Africa). Corona terminology, fully explained in the description, is based on a recent study of corona types in Asclepiadaceae and Periplocaceae (Liede & Kunze, unpublished). To account for the present unsatisfactory taxonomic situation of the Old World species of *Sarcostemma*, the term "*S. viminale* and its allies" is used to circumscribe all Old World members of the genus, except for *S. pearsonii* N. E. Br., while the term "*S. viminale*" excludes the segregated species.

Sarcostemma mulanjense Liede & Meve, sp. nov. TYPE: Malawi. Mt. Mulanje, outer slopes at Chitakale stream, W branch, 15°57′S, 35°36′E, 1,250 m, 27 Nov. 1985, *Chapman & Chapman 6892* (holotype, MO). Figures 1, 2.

Sarcostemma viminale R. Br. affinis, sed differt surculis omnino glabris, vivide viridis et altitudine gynostegii quam diametro majore.

Plants succulent, without rhizome, not forming an aboveground trunk, much branched basally, exuding white latex. *Shoots* to 1.5 m long, 3–5 mm diam., bright green, not glaucous, totally glabrous, erect when young, later bending over, but never twining; internodes 15–40(–60) mm long; nodes slightly flattened, without corky sheath; normally not rooting at the nodes. *Leaves* reduced to scales, 1 mm long, 1 mm wide, ovate, apiculate, green when young, soon turning brown apically, deciduous. *Inflorescences* terminal, umbelliform, 5–7-flowered, sessile; pedicels 4–7 mm long, sparsely indumented with trichomes 150–170 μm long. *Buds* conical, 3.5–4 mm long, 2.5–3 mm diam., petals imbricate in bud, dextrorse. *Flowers* sweetly scented, scent *Philadelphus*-like. *Calyx* rotate; sepals 0.9 mm long, 0.8 mm wide, ovate, sparsely indumented with trichomes 150–170 μm long. *Corolla* rotate; corolla lobes fused only at the base, 4–6 mm long, 1.4–1.6 mm wide, cream-colored with reddish tinged base and median stripe, glabrous, patent to almost horizontal at anthesis, oblong, apically blunt with a tip, flat, slightly undulating, with slightly revolute margins. *Gynostegial corona* white, consisting of an outer ring of fused connate staminal (Cs) and interstaminal (Ci) parts, ($C_{(is)}$), plus five inner staminal parts (Cs), connate to $C_{(is)}$. $C_{(is)}$ annular, Cs 1.4 mm high, slightly cucullate, Ci 1 mm high, erect. Inner Cs 2.8–3 mm high, shorter than the gynostegium, cochleariform, connate to the back of the stamens to about ⅔ of anther height. *Gynostegium* sessile, 3.0–3.5 mm high, 1.4–2 mm diam., height clearly exceeding the diameter. *Stamens* trapezoidal, abaxially rounded, filament differentiated, 1.8 mm high; anther wings 0.6 mm long, clearly differentiated, paralleling the anther, parallel to each other, basally forming a distinct "mouth," consisting of outer rail alone; connective appendages 0.5 mm long, 0.5 mm wide, deltate, equaling the stamen in width, slightly inflexed. *Pollinarium:* corpusculum 200–220 μm long; caudicles 60–80 μm long, cylindrical, s-shaped, convex-concave, slightly thickened at the insertion of the pollinium; pollinia apically inserted, 280–380 μm long, 80–100 μm wide, elliptical in cross section, pyriform. Style apex cream, 0.9–1 mm diam, 0.7–0.8 mm high, upper part 0.4–0.5 mm high, higher than the lower part, conical to depressed-conical.

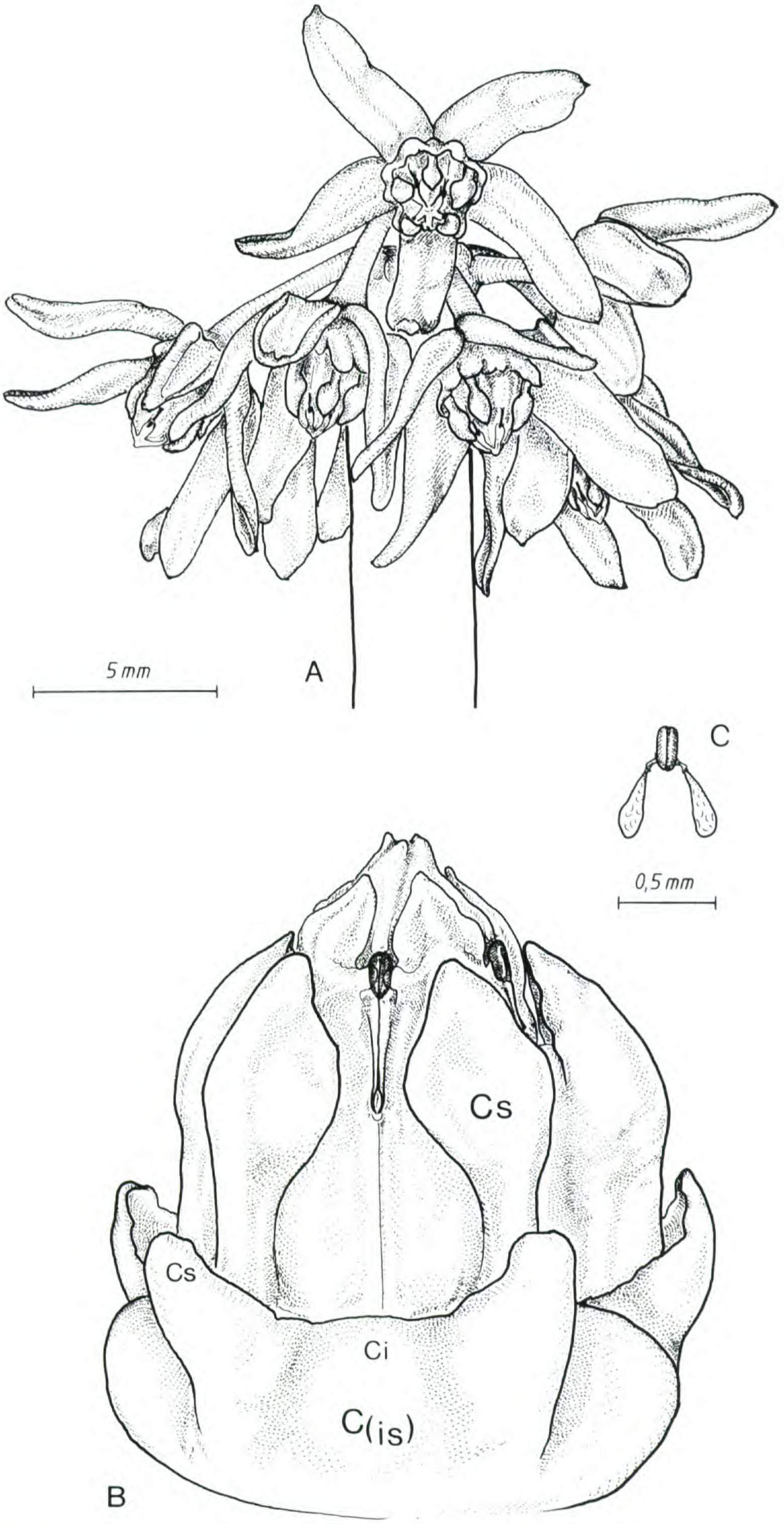

Figure 1. *Sarcostemma mulanjense* Liede & Meve. —A. Inflorescence. —B. Corona and gynostegium. —C. Pollinarium (*Liede 2900*). Ci: interstaminal part of corona; Cs: staminal part of corona; $C_{(is)}$: fused staminal and interstaminal parts of corona.

Figure 2. *Sarcostemma mulanjense* in habitat on the Lichenya Plateau, Mt. Mulanje (*Liede 2899*). Note the cushionlike growth form and the dead branches of the last season.

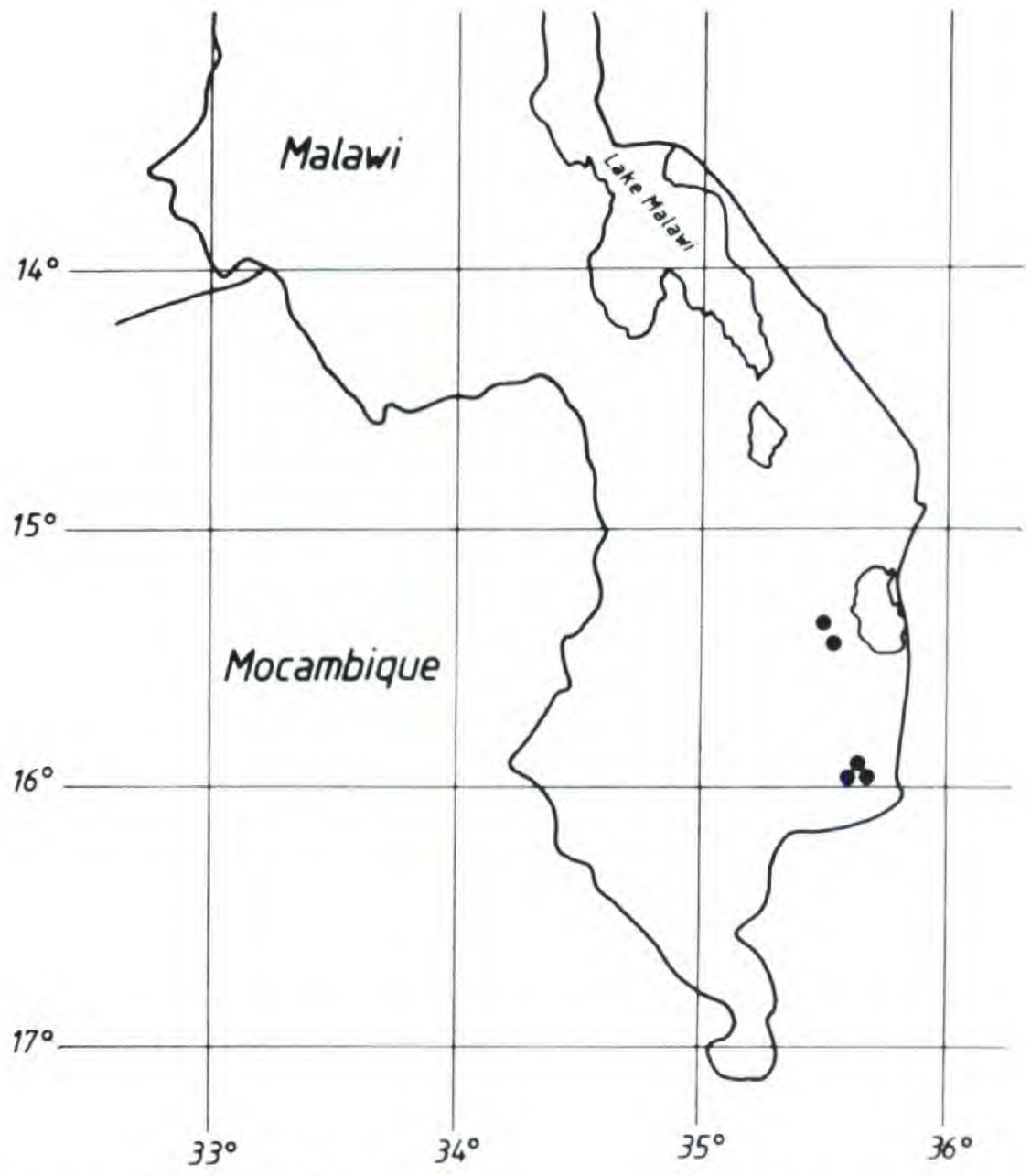

Figure 3. Distribution of *Sarcostemma mulanjense*.

Follicles and *seeds* unknown. *Chromosome number:* $2n = 22$ (Voucher: *Liede 2900*).

Distribution. Malawi, 15–17°S, 35–36°E; 900–2,100 m; on granitic outcrops between sedges, *Aloe*, and Velloziaceae (Figs. 2, 3).

Flowering time. November–April (according to dates on flowering specimens).

Paratypes. MALAWI. MULANJE: Mt. Mulanje, approach to Cilemba from the Likhubula valley, 15°57′S, 35°36′E, 2,100 m, 13 Mar. 1986, *Chapman & Chapman 7285* (MO); ascent from Likhubula via Chapaluka path, 19 Jan. 1967, *Hilliard & Burtt 4504* (NU); Lichenya Plateau, near the Crater, 1,900 m, 16 Apr. 1991, *Liede 2899* (Inst. Bot. Münster); Lichenya Plateau, between hut and the Crater, 1,900 m, 16 Apr. 1991, *Liede 2900* (Inst. Bot. Münster); foot near Likhubula Forest station, 900 m, 17 Apr. 1991, *Liede 2902* (Inst. Bot. Münster). ZOMBA: Nkhoronje Hill, 15°25′S, 35°20′E, 1,120 m, 12 Apr. 1983, *La Croix 2425* (BM); Zomba Mt., 15°17′S, 35°17′E, 20 Nov. 1979, *Banda & Salubani 1617*, 1,600 m, 10 Mar. 1985, *La Croix 2731*, 27 Jan. 1978, *Seyani 765* (all MO).

Sarcostemma mulanjense possesses the corona structure $C_{(is)}$ + Cs (an outer ring consisting of fused staminal and interstaminal parts plus five inner staminal lobes) characteristic of *Sarcostemma* (Fig. 1B). *Cynanchum*, in contrast, always lacks inner staminal lobes; its corona can be described as $C_{(is)}$ (a single corona consisting of fused staminal and interstaminal parts). From all other African *Sarcostemma* species, *S. mulanjense* is readily distinguished morphologically by the height of the gynostegium exceeding its diameter. In addition, the cochleariform inner Cs, the well-differentiated parts of Cs and Ci in the outer C(is) and the flat, slightly undulating, cream-colored corolla lobes set it apart from *S. viminale*. Ecologically, it is different in its preference for high altitudes and undisturbed vegetation (Fig. 2).

Species rank seems appropriate for this taxon, because the changes in gynostegium proportions indicate a considerable time of independent evolution, due to its isolation in the southern Malawi mountains. Mechanical difficulties in inserting the slightly larger pollinia of *S. viminale* into the guide rails of *S. mulanjense* support at least some degree of reproductive isolation. No difficulties have been encountered when introducing *S. mulanjense* pollinia into guide rails of *S. viminale;* however, no fruit set has resulted from all crosses tried. In nature, interbreeding of the two taxa is highly unlikely, because populations of *S. viminale* are known only from localities considerably further south (Zimbabwe) or further north (Rumpi District).

Specimens from high altitudes of Mt. Mulanje

exhibit a dense cushion-shaped habit. Longer shoots die back during the winter, probably due to frost, and only the lowermost 4–6 internodes survive. Resprouting occurs from the nodes underneath the black remnants of the shoots of the previous season (Fig. 2). These resprouts remain comparatively short and erect. In cultivation, however, these specimens show the same arching growth form as those from the base of the mountain and the Zomba plateau.

Acknowledgments. We thank F. Albers, Münster, for the use of facilities. Fieldwork was sponsored by the Deutsche Forschungsgemeinschaft (Liede, grant No. 477/25/91). E. v. Jaarsveld, Kirstenbosch, and L. E. Newton, Nairobi, have enthusiastically participated in fieldwork. Loan of material from the herbaria mentioned is gratefully acknowledged.

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Two New Combinations in *Sechium* (Cucurbitaceae) from Central America, and a New Species from Oaxaca, Mexico

Rafael Lira and Fernando Chiang
Herbario Nacional de México, Apdo. Postal 70-367, 04510 México, D.F., Mexico

ABSTRACT. Based on studies of herbarium collections, fieldwork in Mexico and Central America, and palynological evidence, two species of *Frantzia* (*F. panamensis* and *F. venosa*) are transferred to *Sechium*, and a species in this genus (*S. chinantlense*) from the lowlands of Oaxaca is described as new. A key to the 10 species of *Sechium* is presented.

According to the most recent classification of the Cucurbitaceae (Jeffrey, 1990), the genus *Sechium* P. Browne belongs to tribe Sicyeae, subtribe Sicyinae. Ever since Jeffrey's (1978) work, in which a broader generic circumscription of *Sechium* was presented (encompassing *Ahzolia* Standley & Steyerm., *Frantzia* Pittier, and *Polakowskia* Pittier), there has been a growing interest in the genus. Cruz-León (1985–1986) and Cruz-León & Querol-Lipcovich (1985) reported wild populations of *S. edule* (Jacq.) Sw. found in 1982–1983 in Veracruz, Mexico. Newstrom (1985, 1986, 1989, 1990, 1991) presented the results of her research on the origin and evolution of this species, reporting new localities for wild populations of the species in Oaxaca, Mexico, and proposing a different generic circumscription.

Studies of collections (including type material) of all species of *Sechium* and related genera, fieldwork in Mexico and Central America (Lira, 1990, 1991; Lira & Soto, 1991), and palynological studies of species of most of the genera of subtribe Sicyinae (Lira & Alvarado, 1991) have revealed new evidence supporting Jeffrey's (1978) generic circumscription. Taking into account all the above-mentioned works, we propose two new combinations and a new species of *Sechium*.

Sechium panamense (Wunderlin) Lira & Chiang, comb. nov. Basionym: *Frantzia panamensis* Wunderlin, Bull. Torrey Bot. Club 104: 102. 1977. TYPE: Panama. Chiriquí: Boquete District, Bajo Chorro, 6,000 ft., *Davidson 416* (holotype, F, photograph).

Geographical distribution. Apparently endemic to Panama, known only from the type locality, at elevations between 1,800 and 3,000 m.

Additional specimens examined. PANAMA. CHIRIQUI: top of peak between Baru and Respinga, ca. 3,000 m, 27 Nov. 1975, *D'Arcy 10135* (MO); Cerro Pata de Macho, ca. 5 mi. NE of Boquete, trail to continental divide leading to Finca Serrano (Francisco Serrano, Pacific slope), 22 Nov. 1979, *Antonio 2687* (MO); Bugaba, Cerro Punta, along ridge to watershed to Bocas del Toro, 8°52′N, 82°33′W, 2,200 m, 26 Jan. 1985, *van der Werff & Herrera 6458* (MO).

Sechium venosum (L. D. Gómez) Lira & Chiang, comb. nov. Basionym: *Frantzia venosa* L. D. Gómez, Phytologia 53: 447. 1983. TYPE: Costa Rica. Limón: along road from Hone Creek to Bribri, *Gómez et al. 20483* (holotype, MO; isotypes, BM, CR, K).

Geographical distribution. Originally reported (Gómez & Gómez, 1983) as endemic to the lowlands of Caribbean Costa Rica, it has now been found at higher elevations (1,300–1,650 m) and also in Panama.

Additional specimens examined. COSTA RICA. LIMON: Talamanca, 7 km SW of BriBri, 100 m, 4 May 1983, *Gómez et al. 20361* (MEXU, MO), *20459* (BH, BM, K, MEXU, MO); Limón, 1–3 km N of BriBri, Río Sixaola drainage, 9°38′N, 82°50′W, 250 m, evergreen premontane wet and tropical moist forest formation and cocoa plantation, 9–10 Sep. 1978, *Burger & Antonio 11014* (CR, F); Costado E, Lago Dabagri, 9 Nov. 1984, *Gómez et al. 23309-B* (MO); Hitori Cerere Reserve and vicinity in Valle La Estrella S of Finca Concepción in woods on slope along Río Cerere, 9°42′N, 83°02′W, 100 m, 31 July 1985, *Hammel & Grayum 14297* (CR); forested hill above BriBri, 100 m, 2 Feb. 1984, *Pennington & Poveda 11465* (CR); base of hills between Punta Cocles and Punta Uva (E of Puerto Viejo de Talamanca), 9°38′N, 82°43′W, 20–60 m, forested ravine, 6 Nov. 1984, *Grayum et al. 4426* (BM, CR, MO); San José Cabecar, 4–23 Mar. 1982, *Ocampo s.n.* (CR); Cantón Talamanca, ca. 3 km sobre el camino maderero que va a Cataratas, 9°38′N, 82°55′W, borde de selva alta perturbada con *Cecropia*, *Heliconia* spp., Urticaceae y Malvaceae, 150 m, 10 Aug. 1990, *Lira & Ocampo 1036* (MEXU); camino al puente del Río Uatsi (ahora destruido), viniendo de Cruce Bribri y Uatsi, 9°37′N, 82°52′W, selva alta perturbada, con cultivos de plátano y cacao, 100 m, 10 Aug. 1990, *Lira & Ocampo 1039* (MEXU) (only fruits were collected). PUNTARENAS: foothills of the Cordillera de Talamanca, between Agua Caliente and the Río Canasta, 8°57′–9°2′N, 82°56′–82°59′W, 1,300–1,650 m, montane forest remnants scattered among pastures, 5 Sep.

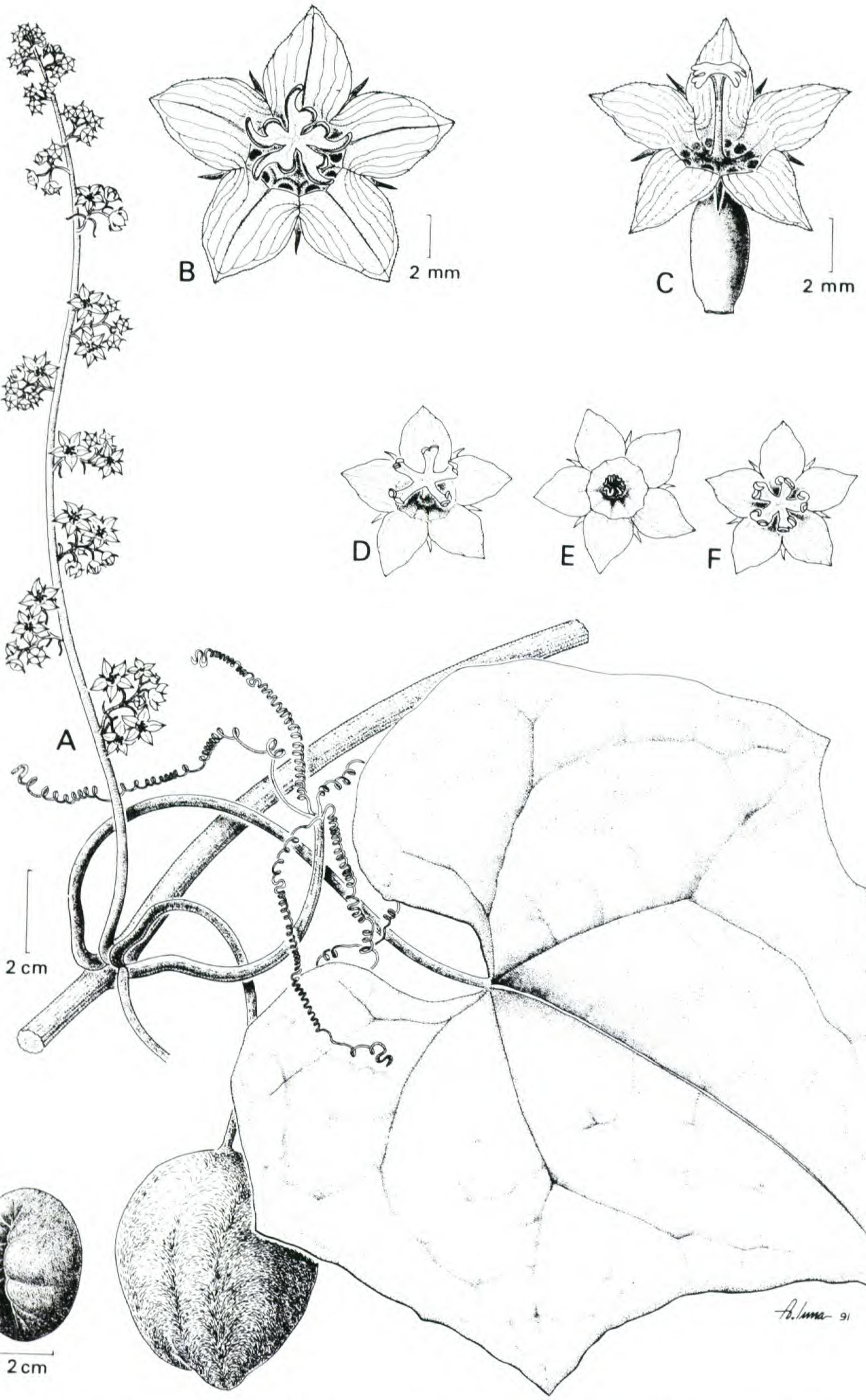

Figure 1. *Sechium chinantlense* Lira & Chiang. —A. Habit. —B. Staminate flower. —C. Pistillate flower. —D. Staminate flower of *S. hintonii*. —E. Staminate flower of *S. pittieri*. —F. Staminate flower of wild *S. edule*. —G. Apical view of the fruit showing the cleft.

1984, *Davidse et al. 28360* (MO). PANAMA. BOCAS DEL TORO: vicinity of Nievecita, 0–50 m, 8–19 Aug. 1938, *Woodson Jr. et al. 1841* (MO); Nievecita, 3–20 Aug. 1940, *Woodson Jr. & Schery 1026* (NY).

Sechium chinantlense Lira & Chiang, sp. nov. TYPE: Mexico. Oaxaca: Municipio San Lucas Ojitlán, del poblado El Zapotal a Mata de Caña, relictos de selva alta perennifolia, 60 m, 23 Jan. 1989, *Calzada 14297* (leaves, stam. fl., and mature fr.) (holotype, MEXU). Figure 1.

Sechio eduli (Jacq.) Sw. proximum, a quo differt pedicellis florum masculorum longioribus, filamentis staminalibus per ½–¾ longitudinis connatis, columnam formantibus, hac in 5 ramis divisa, unoquoque ramo in 2 ramis inaequalibus diviso, et fructu constanter glabro, inermi, lateraliter compresso, laete viridi.

Stout, monoecious, perennial vine, or sometimes perennating through the massive roots. Stems sulcate, smooth, almost glabrous, much branched, thickened and woody toward the base. Leaves herbaceous to papery membranous when dried, cordate-ovate to suborbicular, 10–16(–17.5) cm long, 12–22.5(–24) cm broad, slightly 3-angulate-lobed, the lobes obtuse, acute to acuminate, margins remotely denticulate, base cordate, sinus usually semiclosed, both surfaces essentially glabrous, the adaxial one scabrous, slightly puberulent only on the veins, minutely white-pustulate, the abaxial one smooth; petioles sulcate, 12–16(–22) cm long, glabrous. Tendrils 4–6-parted, sulcate, glabrous. Staminate inflorescences axillary, racemose-paniculate, pedunculate, 12–27 cm long, puberulent to glabrous, the flowers in fascicles or in short racemelike branches distributed at intervals along the rachis, the branches not exceeding 18 mm; pedicels slender, 4–12 mm long, puberulent to glabrous; receptacle disk-shaped, ca. 1 mm long, 3–5 mm wide, glabrous; sepals 5, narrowly lanceolate to subulate, 1–3.5 mm long; petals 5, spreading, white to greenish white, triangular-ovate, obtuse to acute, 4–8 mm long, 2.5–4.5 mm broad, with 7–9 parallel nerves, puberulent, glabrescent; stamens 5, 3–4 mm long; filaments fused ½–¾ their length, forming a thin column, divided into 5 branches somewhat broadened and flat, spreading, these again divided into two unequal-sized and curved branches; antheriferous tissue at the tip of the branches, visible mainly at the margins and underneath; nectaries 10, porelike, surrounding the staminal column at the base of the receptacle, puberulent on the surface, slightly projected underneath the calyx or not at all projected. Pistillate flowers in the same axil as the staminate inflorescences, 1–3 on individual pedicels, sometimes geminate on the same pedicel; pedicel slender, sulcate, ca. 1 cm long, elongating up to 10 cm in fruit, glabrous; ovary ovoid, constricted at the tip, glabrous, smooth, 1-ovuled; perianth as in the staminate flowers but somewhat reduced; styles fused into a slender column, 3 mm long; stigma 2-lobed, each lobe 3-fid; nectaries as in the staminate flowers, but less evident. Fruits fleshy, obovoid, compressed, 6–9 cm long and nearly as broad in the middle, cleft at the apex, glabrous, unarmed, bright green when mature, pulp pale green to whitish, bitter; seed ovoid, flattened, smooth, 3.5–6 cm long.

Sechium chinantlense is known only from northern Oaxaca, from the region known as "La Chinantla" in the municipios Valle Nacional, Tuxtepec, Chiltepec, Santa María Jacatepec, and San Lucas Ojitlán, where it thrives at altitudes between 20 and 800 m, in evergreen forest or at higher elevations, in the transition between evergreen and montane forest. The populations from south of Valle Nacional start blooming in August and set fruit in October or earlier, whereas the ones from Chiltepec and San Lucas Ojitlán produce flowers until November and fruits from December to January and February. An explanation for these differences could be found in the higher humidity and lower temperatures present in the Valle Nacional area, compared to the warmer and somewhat drier climate of the north.

Paratypes. MEXICO. OAXACA: Mpio. San Lucas Ojitlán, Ejido O. Terán, Presa Cerro de Oro (Santo Domingo), al S de San Lucas Ojitlán, 18°2′N, 96°25′W, relictos de selva mediana con *Bursera* creciendo sobre lomeríos muy pedregosos y rodeados de planicies con suelos muy húmedos, 60 m, 24 Oct. 1990, *Lira & Soto 1173* (MEXU); Mpio. Santa María Jacatepec, Plan Martín Chino, acahual derivado de selva alta perennifolia, 60 m, suelo negro rocoso con lomeríos, 25 Oct. 1989, *Calzada 15043* (MEXU); Mpio. Chiltepec, Cerro Faisán, 6 km al W de Chiltepec, 17°58′N, 96°15′W, milpas en lomeríos rocosos rodeados con relictos de selva mediana con *Bursera*, *Gliricidia*, *Ceiba*, *Enterolobium*, Araceae y Sapindaceae, y éstos a su vez rodeados por grandes extensiones de potreros, 60 m, 24 Oct. 1990, *Lira & Soto 1176* (MEXU); Chiltepec and vicinity, in llanos, 20 m, 12 Dec. 1940, *Martínez-Calderón 369* (GH, MEXU), 14 Jan. 1941, *458* (GH); Mpio. Valle Nacional, km 61 de la carretera Tuxtepec–Oaxaca, selva mediana, 730 m, 28–31 Oct. 1991, *Castrejón & Concepción 183, 194, 212* (MEXU); 12 km al S de Valle Nacional, carretera 175 a Oaxaca, 17°41.3′N, 96°20.5′W, ladera húmeda con una caída de agua, selva alta perennifolia perturbada con *Cecropia*, 720 m, 25 Oct. 1990, *Lira & Soto 1185* (MEXU); 12.5 km al S de Valle Nacional, carretera 175 a Oaxaca, 17°41.2′N, 96°19.5′W, ladera húmeda con una caída de agua, selva alta perennifolia perturbada, 720 m, 25 Oct. 1990, *Lira & Soto 1186* (MEXU); 13.5 km al S de Valle Nacional, carretera 175 a Oaxaca, 17°41′N, 96°19.5′W, ladera húmeda con una caída de agua, selva alta perennifolia, 730 m, 25 Oct. 1990, *Lira & Soto 1187* (MEXU); 15 km al S de Valle Nacional, casi 1 km

al N de Puerto Eligio, carretera 175 a Oaxaca, 17°38′N, 96°20′W, ladera húmeda con una caída de agua, selva alta perennifolia perturbada, 660 m, 26 Oct. 1990, *Lira & Soto 1188* (MEXU); steep mountain sides above and generally 9 mi. S of Valle Nacional, along the highway to Oaxaca, 800 m, 10 Oct. 1962, *McVaugh 21801* (MICH); a 11 km al S de Valle Nacional, carretera Tuxtepec–Oaxaca, selva alta perennifolia, 850 m, *Soto et al. 13191* (MEXU).

Specimens of *Sechium chinantlense* have been identified and/or reported as *S. compositum* (J. D. Smith) C. Jeffrey, or as a hybrid between the latter and *S. edule* or a different species (Newstrom, 1985, 1986, 1989, 1990, 1991). The characteristics shown by the stamens and fruits permit the separation of *S. chinantlense* from other species of the genus (see Fig. 1). Furthermore, the absence of *S. compositum* in Oaxaca does not support the contention that the new species is a hybrid between *S. compositum* and any other species. In this regard, populations of wild *S. edule* can be found growing in the vicinity (although at higher elevations) of populations of *S. chinantlense* in the south of Valle Nacional, Oaxaca. However, an examination of both populations did not yield evidence of hybridization, indicating that, notwithstanding their vicinity and similar phenology, these two species are probably reproductively isolated. On the other hand, in the northern part of the range of *S. chinantlensis*, there are no wild populations of *S. edule*.

With these three additions, *Sechium* is now considered to include 10 species forming the two sections proposed by Jeffrey (1978). Based on our observations, as well as some additional bibliographic information (Wunderlin, 1976, 1977, 1978), we propose the following key to distinguish the sections and the species.

Key to the Sections and Species of *Sechium*

1a. Nectaries surrounding base of reproductive structures, pore- or pouchlike, sunken into the base of receptacle and ± protruding beneath ..... section *Sechium*
  2a. Filaments completely fused; anthers free, sessile on the tip of the filament column; floral nectaries conspicuously protruding beneath the receptacle.
    3a. Lower surface of the leaves pubescent; floral nectaries tomentellous on upper surface ..... *S. talamancense* (Wunderlin) C. Jeffrey
    3b. Lower surface of the leaves glabrous; floral nectaries glabrous on upper surface ..... *S. tacaco* (Pittier) C. Jeffrey
  2b. Filaments partially fused, about ½–¾ their length and then divided into 3–5 branches; anthers 3–5 (sometimes more) at the tip of the filament branches; floral nectaries not protruding beneath the receptacle, or only slightly so.
    4a. Filament branches not or inconspicuously divided; mature fruits variable in size, shape, indument, and armature.
      5a. Male inflorescence paniculate; pedicels 7–20 mm long; mature fruits 6–10 cm long, fleshy, with longitudinal ridges and short spines on the ridges, to completely smooth and unarmed (Chiapas and Guatemala) ..... *S. compositum* (J. D. Smith) C. Jeffrey
      5b. Male inflorescence racemose, or if more divided, the branches very short and the pedicels less than 6 mm; mature fruits fleshy to woody-fibrous with or without ridges, angles or furrows and spines.
        6a. Male inflorescence erect; filaments fused more than ¾ their total length; mature fruits fleshy, variable in size, shape, and armature; wild (bitter fruits; Mexico in the states of Veracruz, Hidalgo, Puebla, and Oaxaca) and cultivated (nonbitter fruits) plants ..... *S. edule* (Jacq.) Sw.
        6b. Male inflorescence pendulous; filaments fused ½–¾ their total length; mature fruits 3–4.5 cm long, woody-fibrous, with 5 longitudinal ridges, the ridges with thin spines covered by retrorse barbs; wild plants (Estado de México and Guerrero) ..... *S. hintonii* (P. G. Wilson) C. Jeffrey
    4b. Filament branches divided into two unequal-sized and curved branches; mature fruits 6–9 cm long, ovate-cordate, consistently smooth, unarmed, and bright green (Oaxaca) ..... *S. chinantlense* Lira & Chiang
1b. Nectaries surrounding base of reproductive structures, covered by a cushionlike compressed structure, not sunken into the base of the receptacle ..... section *Frantzia*
  7a. Male inflorescence racemose to paniculate, erect or pendulous (Nicaragua to Panama).
    8a. Male inflorescences erect, racemose to racemose-paniculate; flowers conspicuously pedicellate; fruits ovoid to fusiform.
      9a. Male inflorescences densely villous; sepals linear lanceolate, 6–8 mm long; fruits fusiform (Costa Rica) ..... *S. villosum* (Wunderlin) C. Jeffrey
      9b. Male inflorescences not villous; sepals triangular, up to 1 mm long; fruits ovoid (Nicaragua to Panama) ..... *S. pittieri* (Cogn.) C. Jeffrey
    8b. Male inflorescences pendulous, racemose; flowers very shortly pedicellate to almost sessile; fruits ovoid to globose (Costa Rica and Panama) ..... *S. venosum* (L. D. Gómez) Lira & Chiang
  7b. Male inflorescences umbelloid (Panama) ..... *S. panamense* (Wunderlin) Lira & Chiang

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New Combinations and Nomenclatural Notes on the Genera *Salacia* and *Tontelea* (Celastraceae, Sensu Lato) in the Neotropics. V.

Alberta M. W. Mennega
Department of Plant Ecology & Evolutionary Biology, Herbarium Division,
University of Utrecht, Heidelberglaan 2, P.O. Box 80.102,
3508 TC, Utrecht, The Netherlands

ABSTRACT. The increase in collections of Hippocrateaceae, in particular from Andean regions, has led to several taxonomic and nomenclatural changes in the genera *Salacia* and *Tontelea*. Miers's *Thermophila cordata* is reestablished as *Salacia cordata*; *S. acreana* and *S. megistophylla* are considered to be synonyms. *Salacia pittieriana* is placed in synonymy with *S. multiflora*. *Salacia mucronata* is treated as a subspecies of *S. multiflora*. *Tontelea richardii* is considered as a subspecies of *T. ovalifolia*, and *T. fluminensis* placed in synonymy with the latter species. Other changes in *Tontelea* concern the transfer of *T. ulei* to *Salacia ulei*. *Krukoff 5141*, the type of Smith's *Salacia petiolata*, later transferred by him to *Tontelea ulei*, is treated here as *T. petiolata*.

Salacia cordata (Miers) A. M. Mennega, comb. nov. Basionym: *Thermophila cordata* Miers, Trans. Linn. Soc. London 28: 401. 1872. TYPE: Peru. *Pavón s.n.* (holotype, BM; isotype, G).

Salacia acreana A. C. Smith, Bull. Torrey Bot. Club 66: 243. 1939. Syn. nov. TYPE: Brazil. Acre: *Krukoff 5523* (holotype, NY; isotypes, A, F, MICH, S, U, US).

Salacia megistophylla Standl., Publ. Field Mus. Nat. Hist. Bot. Ser. 4: 222. 1929. Syn. nov. TYPE: Panama. Bocas del Toro: Crica Mola Valley, *Cooper 503* (holotype, F).

In 1872, Miers came across a Pavón collection in the British Museum which, despite the lack of flowers on the inflorescence, he recognized as belonging to the Hippocrateaceae. He placed it in the genus *Thermophila* and named it *T. cordata* Miers, which he considered closely related to *T. macrophylla* Miers (= *Salacia miqueliana* Loes.).

I studied additional material of the Pavón collection in the herbarium at Geneva. These sheets also lack flowers, but they have the same characteristic large leaves with a more or less cordate base and a rather short, several-branched inflorescence. I support Miers' opinion that the Pavón material represents a good species, despite the absence of flowers. Because *Thermophila* is now placed in synonymy with *Salacia*, this species is here named *Salacia cordata* (Miers) A. M. Mennega.

Salacia multiflora (Lam.) DC. Prodr. 1: 570. 1824. Basionym: *Hippocratea multiflora* Lam. Tab. Encycl. 1: 101. 1791. TYPE: French Guiana. *Richard s.n.* (holotype, P).

Salacia pittieriana A. C. Smith, Brittonia 3: 440. 1940. Syn. nov. TYPE: Venezuela. Aragua: Parque Nacional, *L. Williams 10332* (holotype, F; isotype, US).

Salacia multiflora subsp. **mucronata** (Rusby) A. M. Mennega, comb. nov. Basionym: *Salacia mucronata* Rusby, Descr. S. Amer. Pl. 53. 1920. TYPE: Venezuela. Delta Amacuro: lower Río Orinoco, *Rusby & Squires 130* pro parte (holotype, NY; isotypes, A, F, G, GH, MICH, US).

In his treatment of *Salacia*, Smith (1940) recognized a number of species groups, two of which are closely related: *Multiflorae*, with the single species *S. multiflora*, and *Mucronatae*, with two species (*S. mucronata* and *S. pittieriana*). The differentiating characters between these groups are slight variations in the form of the disk and the mode of dehiscence of the anthers.

After studying a large number of specimens belonging to this alliance I found it hard to distinguish *S. pittieriana* from *S. multiflora*. The coriaceous leaves of *S. pittieriana* were also occasionally found in *S. multiflora*, and the disk characters were not clearly distinctive. *Salacia mucronata*, though closely related to *S. multiflora*, can be distinguished from the latter by a strictly dichotomously branched inflorescence with smaller-sized flowers. I consider it to be a subspecies of *S. multiflora*.

Tontelea ovalifolia (Miers) A. C. Smith, Brittonia 3: 476. 1940. Basionym: *Cuervea ovalifolia* Miers, Trans. Linn. Soc. London 28: 371. 1872.

TYPE: Colombia. Meta: Villa Vicencio, *Triana s.n.* (holotype, K).

Tontelea ovalifolia subsp. **richardii** (Peyr.) Görts & A. M. Mennega, comb. et stat. nov. *Salacia richardii* Peyr. in C. Martius, Fl. Bras. 11 (1): 148. 1878. Syn. nov. TYPE: French Guiana. *Richard s.n.* (holotype, P).

Salacia fluminensis Peyr. in C. Martius, Fl. Bras. 11 (1): 149. 1878. Syn. nov. *Tontelea fluminensis* (Peyr.) A. C. Smith, Brittonia 3: 477. 1940. TYPE: Brazil. *Riedel s.n.* (holotype, F; isotypes, GH, K, P, US).

According to Smith's (1940) classification, the three species cited above belong in the species group *Attenuatae*, together with several other species; in his key to this group, the three are placed close together. The main differences between the taxa occur in the shape of the leaves and the more or less immersed or prominulous venation. In his discussion on *T. ovalifolia*, Smith pointed out the great variation in leaf size, but he concluded that there was sufficient agreement in leaf shape and texture. Furthermore, he stated that specimens referred to this species and the following (*T. richardii* and *T. fluminensis*) are grouped only with difficulty. With the numerous collections received for identification from Central America and northern South America over a number of years, it became increasingly difficult to distinguish among the three species. Consequently, *T. richardii* and *T. fluminensis* are now placed under synonymy of *T. ovalifolia*. However, because the fruits show a remarkable difference in size and structure, two subspecies are recognized. Fruits of *T. ovalifolia* subsp. *ovalifolia* are of moderate size, 3–5 × 5 cm, and the pericarp is thin and leathery, whereas the fruits of *T. ovalifolia* subsp. *richardii* are very large and more or less globose, 8 × 10 cm, and the pericarp is woody, ca. 10 mm thick.

The holotype of *T. richardii* from French Guiana is a flowering specimen without fruits. Specimens with big woody fruits were collected in Panama, in the Canal Zone on Barro Colorado Island by several collectors, e.g., *Wetmore, Abbe & Shattuck 92, Shattuck 658*. Smith identified these collections as *T. richardii*, notwithstanding the distributional gap. Fruits of *T. fluminensis* were described by Riedel (ex Peyritsch, 1878) as "maximus, magnitudine capitis infantis," which agrees well with the *T. richardii* material. Among the scarce fruiting specimens recently collected is *M. Monsalve B 762* from Colombia, Valle del Cauca. This material has flowers and big, thick-walled fruits. It was first determined as *T. fluminensis*, but is now considered to be *T. ovalifolia* subsp. *richardii*.

Salacia ulei Loes., Verh. Bot. Vereins Prov. Brandenburg 48: 178. 1907. *Tontelea ulei* (Loes.) A. C. Smith, Brittonia 3: 498. 1940. TYPE: Brazil. Amazonas: Rio Juruá, Marary, *Ule 5050* (holotype, B destroyed; photo of type, F; lectotype, selected here, G; isotype, L).

Salacia cuspidata A. C. Smith, Bull. Torrey Bot. Club 66: 248. 1939. Syn. nov. TYPE: Brazil. Amazonas: near Palmares, São Paulo de Olivença, *Krukoff 8415* (holotype, NY; isotypes, BM, F, K, S, U, US; paratype, same locality, *Krukoff 8255*, A, F, NY, S, U).

When Loesener (1907) described *Salacia ulei*, based on *Ule 5050*, he noted the unusual form of the disk. This disk consists of two parts: a low, thin outer ring, and an inner part that is higher and thicker. Such a disk had not yet been described in Brazilian species of *Salacia*, and Loesener doubted if *Salacia* was the correct genus.

In his treatment of New World Hippocrateaceae, Smith (1940) transferred *Salacia ulei* to *Tontelea*. He did not see the specimen, but based his decision on a photograph of the type and on Loesener's description. He regarded the double disk as "traumatic." If the double disk is not taken into account, the plant might indeed be accommodated in *Tontelea*, a genus with a cup-shaped disk. In *Tontelea*, however, the stigmas are usually well developed, whereas *Ule 5050* was described by Loesener as having a style with only minute stigmatic points. In Smith's (1940) treatment of *Tontelea*, there are five species that lack prominent stigmas. These were placed in the species group *Nectandrifoliae*. The Ule specimen was treated as *T. ulei* in this rather aberrant group. Smith also assigned several other collections to *T. ulei: Cardenas 1763* from Bolivia, and *Krukoff 4755* and *5141* from Amazonas, Brazil.

I studied the type specimen, as well as the other specimens cited above. The flowers of *Ule 5050*, in accordance with Loesener's (1907) ample description, show a disk consisting of two parts. At the time of Loesener's paper, such a disk was unknown in *Salacia*. In later collections, however, Smith noticed in three more species of *Salacia* a disk with a flat basal part and a conical inner part, very similar to the disk in *Ule 5050;* this was found each time combined with a branched inflorescence. He placed these species in his group *Arboreae* of *Salacia*. One of the species in this group, which includes five species in total, is *S. cuspidata* A. C. Smith. The type specimen of *S. cuspidata, Krukoff 8415*, resembles *Ule 5050* in several respects. In addition

to the identical disks, both collections share the absence of stigmas, the short-branched inflorescences, and the characteristic narrowly cuspidate leaf apex. Therefore, I consider the two collections as conspecific and belonging in *Salacia*, species group *Amplectentes* (Mennega, 1984).

Recent collections of *Salacia ulei* include: PERU. LORETO: Iquitos, *Asplund 14505* (S), *Vásquez 3373* (MO, U); Río Ucayala, *Vásquez et al. 7027* (MO, U).

As stated above, Smith also included a fruiting specimen, *Cárdenas 1763* (US), in *Tontelea ulei*. The leaves of this plant, however, lack the characteristic cuspidate apex of *Tontelea ulei*, and they much better resemble the leaves of *T. ovalifolia*. Therefore, I exclude this collection from *T. ulei*.

Krukoff 4755 (NY), a fruiting specimen, does not belong in *T. ulei* either. It has large concolorous leaves with an obtuse apex that in venation and texture suggests *Salacia cordata* (Miers) A. M. Mennega. The globose brownish fruits also agree with this species. The third collection, *Krukoff 5141* (A, NY), is a vine that is the type of *Salacia petiolata* A. C. Smith. This species was included in the synonymy of *Tontelea ulei* by Smith in 1940. From Smith's description and from my own observations of the only flower present on the sheet, it is clear that this plant truly belongs in *Tontelea* and in the species group *Nectandrifoliae*, necessitating the new combination below.

Tontelea petiolata (A. C. Smith) A. M. Mennega, comb. nov. Basionym: *Salacia petiolata* A. C. Smith, Bull. Torrey Bot. Club 66: 242. 1939. TYPE: Brazil. Amazonas: basin of Rio Juruá, near mouth of Rio Embira, *Krukoff 5141* (holotype, NY; isotype, A).

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Smith, A. C. 1940. The American species of Hippocrateaceae. Brittonia 3: 341–555.

Validation of Subclass and Superordinal Names in Magnoliophyta

James L. Reveal
Department of Botany, University of Maryland,
College Park, Maryland 20742-5815, U.S.A.

ABSTRACT. Three subclass and 40 superordinal names now in current use, but not validly published, are validated.

In recent years, several authors have adopted subclass and superordinal names in Magnoliophyta, the flowering plants (Cronquist, 1981; R. Dahlgren, 1980; Dahlgren & Clifford, 1981, 1982; Dahlgren & Bremer, 1985; Dahlgren et al., 1985; G. Dahlgren, 1989a, b; Takhtajan, 1959, 1966, 1969, 1970, 1973, 1980, 1986, 1987; Thorne, 1968, 1976, 1981, 1983, 1992). Unfortunately, except for those proposed by Takhtajan in 1966, almost none have been validly published in accordance with provisions in the *International Code of Botanical Nomenclature* (Greuter et al., 1988). Although the principle of priority is not mandatory for names above the rank of family (Art. 11.4), all names regardless of rank must be effectively and validly published (Art. 6).

All subclass and superordinal names not validly published, but now in current use, are validated below with the exception of two superordinal names (based on Annonaceae and Chenopodiaceae) used by Thorne (1992), for which the validly published Magnolianae Takhtajan (1966) and Caryophyllanae Takhtajan (1966) are available, and a subclass name based on Cornaceae used by Frohne & Jensen (1985). The latter has not been adopted by Cronquist or Takhtajan.

All names proposed here are based on and automatically typified by the type of the genus of an included family name (Art. 16.1) and validated by a direct reference to a validly published description (Art. 32). The terminations are in accordance with those given in Article 16.2 and Recommendation 16A. The rationale for the termination "-anae" for superorders has been discussed elsewhere (Reveal & Bedell, 1983) and is now uniformly adopted by the major workers who use the rank (Takhtajan, 1987; Thorne, 1992).

All proposed new names are currently accepted by Dahlgren (in G. Dahlgren, 1989a, b), Takhtajan (1987), or Thorne (1992). Authors adopting these names are noted by the use of D, T, or Th respectively.

Subclass **Lamiidae** (Lindley) Takhtajan ex Reveal, stat. nov. Based on Lamiaceae Lindley, Nat. Syst. Bot. ed. 2, 275. 1836. TYPE: *Lamium* Linnaeus (1753). T.

Subclass **Ranunculidae** (A. L. de Jussieu) Takhtajan ex Reveal, stat. nov. Based on Ranunculaceae A. L. de Jussieu, Gen. Pl. 231. 1789. TYPE: *Ranunculus* Linnaeus (1753). T.

Subclass **Triuridiidae** (G. Gardner) Takhtajan ex Reveal, stat. nov. Based on Triuridaceae G. Gardner, Trans. Linn. Soc. 19: 160. 1843. TYPE: *Triuris* Miers (1841). T.

Superorder **Aranae** (A. L. de Jussieu) Thorne ex Reveal, stat. nov. Based on Araceae A. L. de Jussieu, Gen. Pl. 23. 1789. TYPE: *Arum* Linnaeus (1753). D, T, Th.

Superorder **Balanophoranae** (L. C. Richard & A. Richard) R. Dahlgren ex Reveal, stat. nov. Based on Balanophoraceae L. C. Richard & A. Richard, Mém. Mus. Hist. Nat. 8: 429. 1822. TYPE: *Balanophora* J. R. & G. Forster (1775). D.

Superorder **Bromelianae** (A. L. de Jussieu) R. Dahlgren ex Reveal, stat. nov. Based on Bromeliaceae A. L. de Jussieu, Gen. Pl. 49. 1789. TYPE: *Bromelia* Linnaeus (1753). D, T.

Superorder **Butomanae** (L. C. Richard) Takhtajan ex Reveal, stat. nov. Based on Butomaceae L. C. Richard, Mém. Mus. Hist. Nat. 1: 366. 1815. TYPE: *Butomus* Linnaeus (1753). T.

Superorder **Campanulanae** (A. L. de Jussieu) Takhtajan ex Reveal, stat. nov. Based on Campanulaceae A. L. de Jussieu, Gen. Pl. 163. 1789. TYPE: *Campanula* Linnaeus (1753). T.

Superorder **Cornanae** (Dumortier) Thorne ex Reveal, stat. nov. Based on Cornaceae Dumortier, Anal. Fam. Pl. 33, 34. 1829. TYPE: *Cornus* Linnaeus (1753). D, T, Th.

Superorder **Cyclanthanae** (Dumortier) Thorne ex Reveal, stat. nov. Based on Cyclanthaceae Dumortier, Anal. Fam. Pl. 65, 66. 1829. TYPE: *Cyclanthus* P. A. Poiteau ex A. Richard (1824). D, T, Th.

Superorder **Eucommianae** (Engler) Takhtajan ex Reveal, stat. nov. Based on Eucommiaceae En-

gler, Syllabus ed. 6, 145. 1909. TYPE: *Eucommia* D. Oliver (1890). T.

Superorder **Euphorbianae** (A. L. de Jussieu) Takhtajan ex Reveal, stat. nov. Based on Euphorbiaceae A. L. de Jussieu, Gen. Pl. 384. 1789. TYPE: *Euphorbia* Linnaeus (1753). T.

Superorder **Fabanae** (Lindley) R. Dahlgren ex Reveal, stat. nov. Based on Fabaceae Lindley, Nat. Syst. Bot. ed. 2, 148. 1836. TYPE: *Faba* J. Hill (1753). T.

Superorder **Gentiananae** (A. L. de Jussieu) Thorne ex Reveal, stat. nov. Based on Gentianaceae A. L. de Jussieu, Gen. Pl. 141. 1789. TYPE: *Gentiana* Linnaeus (1753). D, T, Th.

Superorder **Geranianae** (A. L. de Jussieu) Thorne ex Reveal, stat. nov. Based on Geraniaceae A. L. de Jussieu, Gen. Pl. 268. 1789. TYPE: *Gentiana* Linnaeus (1753). Th.

Superorder **Hydatellanae** (Hamann) Takhtajan ex Reveal, stat. nov. Based on Hydatellaceae Hamann, New Zealand J. Bot. 14: 195. 1976. TYPE: *Hydatella* Diels (1904). T, Th.

Superorder **Juglandanae** (A. Richard ex Kunth) Takhtajan ex Reveal, stat. nov. Based on Juglandaceae A. Richard ex Kunth, Ann. Sci. Nat. (Paris) 2: 343. 1824. TYPE: *Juglans* Linnaeus (1753). T.

Superorder **Lecythidanae** (P. A. Poiteau) Takhtajan ex Reveal, stat. nov. Based on Lecythidaceae P. A. Poiteau, Mém. Mus. Hist. Nat. 13: 143. 1845. TYPE: *Lecythis* Loefling (1758). T.

Superorder **Loasanae** (Dumortier) R. Dahlgren ex Reveal, stat. nov. Based on Loasaceae Dumortier, Comment. Bot. 58. 1822. TYPE: *Loasa* Adanson (1763). D, T, Th.

Superorder **Najadanae** (A. L. de Jussieu) Takhtajan ex Reveal, stat. nov. Based on Najadaceae A. L. de Jussieu, Gen. Pl. 18. 1789. TYPE: *Najas* Linnaeus (1753). T.

Superorder **Nelumbonanae** (Dumortier) Takhtajan ex Reveal, stat. nov. Based on Nelumbonaceae Dumortier, Anal. Fam. Pl. 20, 24. 1829. TYPE: *Nelumbo* Adanson (1763). T.

Superorder **Nepenthanae** (Dumortier) Takhtajan ex Reveal, stat. nov. Based on Nepenthaceae Dumortier, Anal. Fam. Pl. 14, 16. 1829. TYPE: *Nepenthes* Linnaeus (1753). T.

Superorder **Nymphaeanae** (R. A. Salisbury) Thorne ex Reveal, stat. nov. Based on Nymphaeaceae R. A. Salisbury, Ann. Bot. (König & Sims) 2: 70. 1805. TYPE: *Nymphaea* Linnaeus, nom. cons. (1753). D, T, Th.

Superorder **Pandananae** (R. Brown) Thorne ex Reveal, stat. nov. Based on Pandanaceae R. Brown, Prodr. 340. 1810. TYPE: *Pandanus* Linnaeus (1753). D, T, Th.

Superorder **Plumbaginanae** (A. L. de Jussieu) Takhtajan ex Reveal, stat. nov. Based on Plumbaginaceae A. L. de Jussieu, Gen. Pl. 92. 1789. TYPE: *Plumbago* Linnaeus (1753). D, T.

Superorder **Podostemonanae** (L. C. Richard ex C. A. Agardh) R. Dahlgren ex Reveal, stat. nov. Based on Podostemonaceae L. C. Richard ex C. A. Agardh, Aphor. Bot. 125. 1822. TYPE: *Podostemon* Michaux (1803).

Superorder **Polygonanae** (A. L. de Jussieu) Takhtajan ex Reveal, stat. nov. Based on Polygonaceae A. L. de Jussieu, Gen. Pl. 82. 1789. TYPE: *Polygonum* Linnaeus (1753). D, T.

Superorder **Pontederianae** (Kunth) Takhtajan ex Reveal, stat. nov. Based on Pontederiaceae Kunth in Humboldt, Bonpland & Kunth, Nov. Gen. Sp. 1: ed. fol. 211; ed. qu. 265. 1816. TYPE: *Pontederia* Linnaeus (1753). T.

Superorder **Primulanae** (Ventenat) R. Dahlgren ex Reveal, stat. nov. Based on Primulaceae Ventenat, Règne Vég. 2: 285. 1799. TYPE: *Primula* Linnaeus (1753). D.

Superorder **Rafflesianae** (Dumortier) Thorne ex Reveal, stat. nov. Based on Rafflesiaceae Dumortier, Anal. Fam. Pl. 13, 14. 1829. TYPE: *Rafflesia* R. Brown (1821). T, Th.

Superorder **Ranunculanae** (A. L. de Jussieu) Takhtajan ex Reveal, stat. nov. Based on Ranunculaceae A. L. de Jussieu, Gen. Pl. 231. 1789. TYPE: *Ranunculus* Linnaeus (1753). D, T.

Superorder **Rhamnanae** (A. L. de Jussieu) Takhtajan ex Reveal, stat. nov. Based on Rhamnaceae A. L. de Jussieu, Gen. Pl. 376. 1789. TYPE: *Rhamnus* Linnaeus (1753). T.

Superorder **Santalanae** (R. Brown) Thorne ex Reveal, stat. nov. Based on Santalaceae R. Brown, Prodr. 350. 1810. TYPE: *Santalum* Linnaeus (1753). D, Th.

Superorder **Sarracenianae** (Dumortier) Thorne ex Reveal, stat. nov. Based on Sarraceniaceae Dumortier, Anal. Fam. Pl. 53. 1829. TYPE: *Sarracenia* Linnaeus (1753). T.

Superorder **Solananae** (A. L. de Jussieu) R. Dahlgren ex Reveal, stat. nov. Based on Solanaceae A. L. de Jussieu, Gen. Pl. 124. 1789. TYPE: *Solanum* Linnaeus (1753). D, T, Th.

Superorder **Theanae** (D. Don) Thorne ex Reveal, stat. nov. Based on Theaceae D. Don, Prodr. Fl. Nepal. 224. 1825. TYPE: *Thea* Linnaeus (1753). D, T, Th.

Superorder **Triuridanae** (G. Gardner) Thorne ex Reveal, stat. nov. Based on Triuridaceae G.

Gardner, Trans. Linn. Soc. 19: 160. 1843. TYPE: *Triuris* Miers (1841). D, T, Th.

Superorder **Trochodendranae** (Prantl) Takhtajan ex Reveal, stat. nov. Based on Trochodendraceae Prantl in Engler & Prantl, Nat. Pflanzenfam. III, 2: 21. 1888. TYPE: *Trochodendron* Zuccarini (1839). T.

Superorder **Typhanae** (A. L. de Jussieu) Thorne ex Reveal, stat. nov. Based on Typhaceae A. L. de Jussieu, Gen. Pl. 25. 1789. TYPE: *Typha* Linnaeus (1753). T.

Superorder **Urticanae** (A. L. de Jussieu) Takhtajan ex Reveal, stat. nov. Based on Urticaceae A. L. de Jussieu, Gen. Pl. 400. 1789. TYPE: *Urtica* Linnaeus (1753). T.

Superorder **Violanae** (Batsch) R. Dahlgren ex Reveal, stat. nov. Based on Violaceae Batsch, Tab. Affin. Regni Veg. 57. 1802. TYPE: *Viola* Linnaeus (1753). D, T, Th.

Superorder **Vitanae** (A. L. de Jussieu) Takhtajan ex Reveal, stat. nov. Based on Vitaceae A. L. de Jussieu, Gen. Pl. 267. 1789. TYPE: *Vitis* Linnaeus (1753). D, T.

Superorder **Zingiberanae** (Lindley) Takhtajan ex Reveal, stat. nov. Based on Zingiberaceae Lindley, Key Bot. 69. 1835. TYPE: *Zingiber* G. R. Boehmer, nom. cons. (1760). D, T.

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Validation of Ordinal Names of Extant Vascular Plants

James L. Reveal
Department of Botany, University of Maryland,
College Park, Maryland 20742-5815, U.S.A.

ABSTRACT. Thirty-two ordinal names in current use are validly published.

Of the more than 400 ordinal names based on a validly published generic name currently available for extant vascular plants, more than 60 are not validly published in accordance with provisions in the *International Code of Botanical Nomenclature* (Greuter et al., 1988). Although the principle of priority is not mandatory for names above the rank of family (Art. 11.4), all names regardless of rank must be effectively and validly published (Art. 6). Of the some 60 invalid ordinal names, slightly more than half are in current use (Cronquist, 1981, 1988; G. Dahlgren, 1989a, b; Takhtajan, 1985, 1987; Thorne, 1992). These names are validated below by direct reference to a valid description (Art. 32). A catalog of the validly published, automatically typified ordinal names is in preparation and will be presented in the near future.

All names proposed here are based on and automatically typified by the type of the genus of an included family name (Art. 16.1). All proposed new names are currently accepted by Cronquist (1981, 1988), Dahlgren (in G. Dahlgren, 1989a, b), Takhtajan (1986, 1987), or Thorne (1992). Authors adopting these names are noted by the use of C, D, T, or Th respectively.

Actinidiales (J. Hutchinson) Takhtajan ex Reveal, stat. nov. Based on Actinidiaceae J. Hutchison, Fam. Fl. Pl. 1: 177. 1926, nom. cons. TYPE: *Actinidia* Lindley (1836). T.

Ancistrocladales (J. E. Planchon ex Walpers) Takhtajan ex Reveal, stat. nov. Based on Ancistrocladaceae J. E. Planchon ex Walpers, Ann. Bot. Syst. 2: 175. 1851, nom. cons. TYPE: *Ancistrocladus* Wallich (1829), nom. cons. T.

Aralidiales (Philipson & B. C. Stone) Takhtajan ex Reveal, stat. nov. Based on Aralidiaceae Philipson & B. C. Stone, Taxon 29: 402. 1980. TYPE: *Aralidium* Miquil (1856). T.

Austrobaileyales (Croizat) Takhtajan ex Reveal, stat. nov. Based on Dilleniaceae subfam. Austrobaileyoideae Croizat, J. Arnold Arbor. 21: 404. 1940. TYPE: *Austrobaileya* C. T. White (1933). T.

Buxales (Dumortier) Takhtajan ex Reveal, stat. nov. Based on Buxaceae Dumortier, Comment. Bot. 54. 1822, nom. cons. TYPE: *Buxus* Linnaeus (1753). D, T, TH.

Cercidiphyllales (Engler) H-H. Hu ex Reveal, stat. nov. Based on Cercidiphyllaceae Engler, Syllabus ed. 6, 132. 1909, nom. cons. TYPE: *Cercidiphyllum* Siebold & Zuccarini (1846). D, T, TH.

Chloranthales (Blume) Conzatti & L. C. Smith ex Reveal, stat. nov. Based on Chloranthaceae Blume, Enum. Pl. Javae 1: 78. 1827, nom. cons. TYPE: *Chloranthus* Swartz (1789). D, T.

Crossosomatales (Engler) Takhtajan ex Reveal, stat. nov. Based on Crossosomataceae Engler in Engler & Prantl, Nat. Pflanzenfam. Nachtr. [1:] 185. 1897, nom. cons. TYPE: *Crossosoma* Nuttall (1848). T.

Dioncophyllales (Gilg) Takhtajan ex Reveal, stat. nov. Based on Flacourtiaceae subtrib. Dioncophyllinae Gilg in Engler & Prantl, Nat. Pflanzenfam. ed. 2, 21: 390, 420. 1925. TYPE: *Dioncophyllum* Baillon (1890). T.

Eupomatiales (Endlicher) Takhtajan ex Reveal, stat. nov. Based on Eupomatiaceae Endlicher, Ench. Bot. 425. 1841, nom. cons. TYPE: *Eupomatia* R. Brown (1814). T.

Eupteleales (K. Wilhelm) H-H. Hu ex Reveal, stat. nov. Based on Eupteleaceae K. Wilhelm, Samenpfl. 17. 1910, nom. cons. TYPE: *Euptelea* Zuccarini (1840–1841). C, T.

Fouquieriales (A. P. de Candolle) Takhtajan ex Reveal, stat. nov. Based on Fouquieriaceae A. P. de Candolle, Prodr. 3: 349. 1828, nom. cons. TYPE: *Fouquieria* Kunth (1823). D, T, TH.

Geissolomatales (Endlicher) Takhtajan ex Reveal, stat. nov. Based on Geissolomataceae Endlicher, Ench. Bot. 214. 1841, nom. cons. TYPE: *Geissoloma* Lindley ex Kunth (1830). D, T.

Glaucidiales (Tamura) Takhtajan ex Reveal, stat. nov. Based on Glaucidiaceae Tamura, Bot. Mag. (Tokyo) 85: 40. 1972. TYPE: *Glaucidium* Siebold & Zuccarini (1846). T.

Gunnerales (Meisner) Takhtajan ex Reveal, stat. nov. Based on Gunneraceae Meisner, Pl. Vasc. Gen.: Tab. Diagn. 345, 346, Comm. 257. 1841, nom. cons. TYPE: *Gunnera* Linnaeus (1767). D, T.

Hanguanales (Airy Shaw) R. Dahlgren ex Reveal, stat. nov. Based on Hanguanaceae Airy Shaw, Kew Bull. 18: 260. 1965. TYPE: *Hanguana* Blume (1827). D.

Hydnorales (C. A. Agardh) Takhtajan ex Reveal, stat. nov. Based on Hydnoraceae C. A. Agardh, Aphor. Bot. 88. 1821, nom. cons. TYPE: *Hydnora* Thunberg (1775). T.

Hydrostachyales (Engler) Diels ex Reveal, stat. nov. Based on Hydrostachyaceae Engler, Syllabus ed. 2, 125. 1898, nom. cons. TYPE: *Hydrostachys* Du Petit-Thouars (1806). D, T.

Lactoridales (Engler) Takhtajan ex Reveal, stat. nov. Based on Lactoridaceae Engler in Engler & Prantl, Nat. Pflanzenfam. III, 2: 19. 1888, nom. cons. TYPE: *Lactoris* R. A. Philippi (1865). D, T.

Melanthiales (Batsch) R. Dahlgren ex Reveal, stat. nov. Based on Melanthiaceae Batsch, Tab. Affin. Regni Veg. 133. 1802, nom. cons. TYPE: *Melanthium* Linnaeus (1753). D.

Ochnales (A. P. de Candolle) J. Hutchinson ex Reveal, stat. nov. Based on Ochnaceae A. P. de Candolle, Ann. Mus. Natl. Hist. Nat. 17: 410. 1811, nom. cons. TYPE: *Ochna* Linnaeus (1753). T.

Paracryphiales (Airy Shaw) Takhtajan ex Reveal, stat. nov. Based on Paracryphiaceae Airy Shaw, Kew Bull. 18: 265. 1965. TYPE: *Paracryphia* E. G. Baker (1921). T.

Podocarpales (Endlicher) Pulle ex Reveal, stat. nov. Based on Podocarpaceae Endlicher, Syn. Conif. 203. 1847, nom. cons. TYPE: *Podocarpus* L'Heritier ex Persoon (1807), nom. cons. T.

Rhoipteleales (Handel-Mazzetti) Novák ex Reveal, stat. nov. Based on Rhoipteleaceae Handel-Mazzetti, Repert. Spec. Nov. Regni Veg. 30: 75. 1932, nom. cons. TYPE: *Rhoiptelea* Diels & Handel-Mazzetti (1932). T.

Salvadorales (Lindley) R. Dahlgren ex Reveal, stat. nov. Based on Salvadoraceae Lindley, Nat. Syst. Bot. ed. 2, 269. 1836, nom. cons. TYPE: *Salvadora* Linnaeus (1753). D.

Simmondsiales (Müller Argoviensis) Reveal, stat. nov. Based on Buxaceae trib. Simmondsieae Müller Argoviensis in A. P. de Candolle, Prodr. 16(1): 9, 22. 1869. TYPE: *Simmondsia* Nuttall (1844). T.

Stylidiales (R. Brown) Takhtajan ex Reveal, stat. nov. Based on Stylidiaceae R. Brown, Prodr. 565. 1810, nom. cons. TYPE: *Stylidium* Swartz ex Willdenow (1805), nom. cons. D, T.

Toricelliales (Wangerin) Takhtajan ex Reveal, stat. nov. Based on Cornaceae trib. Toricellieae Wangerin in Engler, Pflanzenr. IV, 229(Heft 41): 18, 31. 1910. TYPE: *Toricellia* A. P. de Candolle (1830). T.

Tropaeolales (A. L. de Jussieu ex A. P. de Candolle) Takhtajan ex Reveal, stat. nov. Based on Tropaeolaceae A. L. de Jussieu ex A. P. de Candolle, Prodr. 1: 683. 1824, nom. cons. TYPE: *Tropaeolum* Linnaeus (1753). D, T.

Velloziales (Endlicher) R. Dahlgren ex Reveal, stat. nov. Based on Velloziaceae Endlicher, Ench. Bot. 101. 1841, nom. cons. TYPE: *Vellozia* Vandelli (1788). D, T.

Welwitschiales (Markgraf) Pulle ex Reveal, stat. nov. Based on Welwitschiaceae Markgraf in Engler & Prantl, Nat. Pflanzenfam. ed. 2, 13: 419. 1926, nom. cons. TYPE: *Welwitschia* J. D. Hooker (1862), nom. cons. T.

Winterales (R. Brown ex Lindley) A. C. Smith ex Reveal, stat. nov. Based on Winteraceae R. Brown ex Lindley, Intr. Nat. Syst. Bot. 26: 1830, nom. cons. TYPE: *Winteria* J. A. Murray (1784), nom. illeg. ≡ *Drimys* J. R. & G. Forster (1775). D, T.

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New Natural Hybrids and Nomenclatural Novelties in *Catasetum* (Orchidaceae) from the Guianas, Ecuador, and Peru

Gustavo A. Romero
Oakes Ames Orchid Herbaria, Harvard University Herbarium,
22 Divinity Avenue, Cambridge, Massachusetts 02138, U.S.A.

Rudolf Jenny
Moosweg 9, 3112 Allmendingen, Switzerland

ABSTRACT. One new *Catasetum* natural hybrid from Guyana is described and illustrated, *Catasetum* ×*guianense*, and two taxa previously described as species are shown to be hybrids, *Catasetum* ×*sodiroi* Schltr. and *C.* ×*violascens* Reichb. f. & Warzc. The latter two are neotypified and lectotypified, respectively. In addition, a lectotype is designated for *Catasetum incurvum* Klotzsch.

An understanding of the pollination biology of *Catasetum* species assemblages and careful attention to reproductive isolation mechanisms have helped to distinguish species from natural hybrids (Dodson, 1962; Romero & Carnevali, 1992, and references therein). Here we present three natural hybrids from distinct geographical areas where species from *Catasetum* subg. *Catasetum* and *Catasetum* subg. *Pseudocatasetum* are found within euglossine bee flight range. The hybrids discussed encompass two of three possible combinations between these two groups: one between *Catasetum longifolium* Lindley (subg. *Pseudocatasetum*) and *C. macrocarpum* (subg. *Catasetum*, sect. *Catasetum*) from the Guianas; one between *Catasetum macroglossum* and *C. expansum* (both in sect. *Catasetum*) from Ecuador; and one between *Catasetum discolor* Lindley (subg. *Pseudocatasetum*) and *C. incurvum* Klotzsch (subg. *Catasetum*, sect. *Catasetum*) from Peru.

Catasetum ×guianense G. Romero & Jenny, nothosp. nov. TYPE: Guyana. Essequibo District, Dawa, Lake Tapakuma, 30 m, 18 Oct. 1974, C. H. Dodson, ex hort. Marie Selby Botanical Gardens *sub Dodson 4476* (holotype, SEL; holotype fragment, AMES). Figure 1.

Planta intermedia ad *Catasetum macrocarpum* Rich. ex Kunth vergens, sed ab eo floribus minoribus, columnae antennis parallelis brevioribus et clinandrio apiculo breviore recedit.

Plant epiphytic, vegetatively indistinguishable from other members of the genus except for the pendent habit and the generally longer, narrower, linear leaves (to 75 cm long and 4 cm wide). Staminate inflorescences pendent, racemose, to 10-flowered, to 30 cm long, developing from fully developed pseudobulbs at the base of the first internode. Staminate flower resupinate. Sepals and petals yellow, wine red, or greenish yellow spotted wine red. Dorsal sepal slightly concave, ovate, acute, 23–25 mm long, 11–13 mm wide; lateral sepals slightly concave, oblong-obovate, acute, slightly oblique, 25–27 mm long, 11–13 mm wide; petals broadly elliptic, acute to shortly apiculate, 18–19 mm wide, 28–29 mm long. Labellum greenish yellow to yellow, internally yellow with wine red spots toward the base or entirely wine red, saccate, the sac 15–17 mm deep, slightly constricted and internally thickened at the opening, the opening subcircular, 12–17 mm diam.; labellum shallowly trilobate apically, with a ridge inside near the apex uniting the lateral lobes behind the mid-lobe, the ridge separated from the mid-lobe by a shallow depression; lateral lobes erect patent, up to 10 mm wide, margins dentate, fimbriate toward the base; middle lobe 2–5 mm long, linguiform, the apex acuminate, acute, to truncate. Column light greenish white to gold, semiterete, straight, apically thickened, shortly rostrate, 16 mm long, 6 mm high, and 10 mm wide; clinandrium shortly apiculate; antennae tapering to a fine point, bilaterally symmetrical, 6–7 mm long, 1.25 mm diam. at the base. Anther orange to yellowish green, 8 mm long, 5 mm wide; viscidium semicircular, 6–7 mm diam.; stipe, before folding, cymbiform, 11–12 mm long and 5–6 mm wide; pollinia two, cleft, waxy, yellow, compressed, 4 mm long and 3 mm wide. Pistillate inflorescence and flower unknown.

Paratypes. GUYANA. Essequibo District, Dawa, Lake Tapakuma, 30 m, 1 Dec. 1975, C. H. Dodson, ex hort. Marie Selby Botanical Gardens *sub Dodson s.n.* (SEL). FRENCH GUIANA. Without locality, 1 Nov. 1990, *Lafontaine s.n.* (AMES). SURINAME. Without locality, ex hort. G. Schiller, W (Herb. Reichenbach No. 24634).

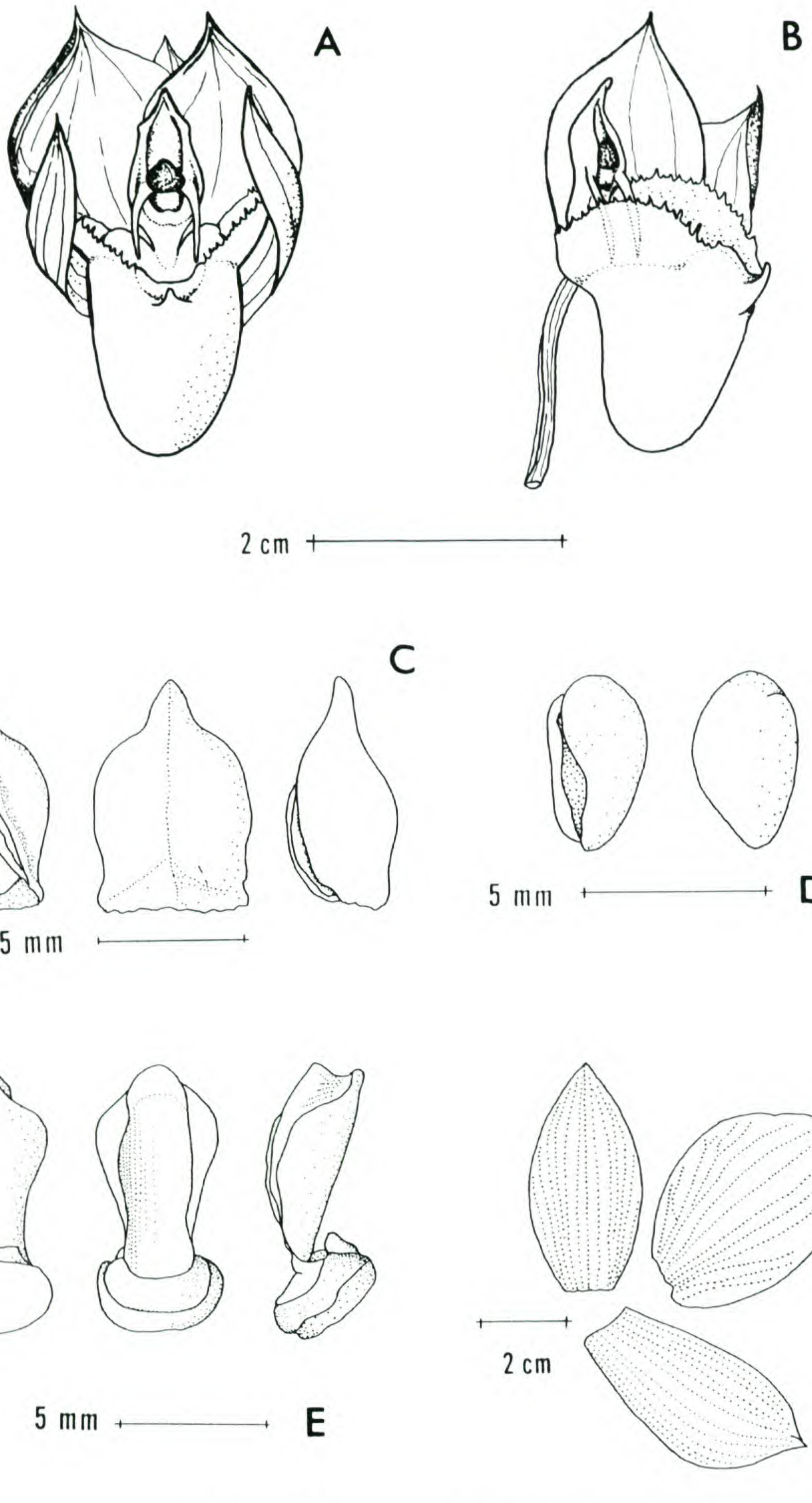


Figure 1. *Catasetum* ×*guianense* G. Romero & Jenny. — A, B. Front and side view of staminate flower. —C. Anther. —D. Pollinium. —E. Pollinarium (pollinia removed). —F. Sepals and petals. (A–F drawn from *Lafontaine s.n.*)

Etymology. Named after the Guianas, a region in northern South America encompassing Guyana, Suriname, and French Guiana, the known geographical range of this natural hybrid.

Dodson (1978) first reported this natural hybrid between *Catasetum macrocarpum* Rich. ex Kunth and *C. longifolium* Lindley without providing a formal name for the taxon. Photographs of the same hybrid swarm had previously been published by Tan (1971, fig. 8). Lafontaine (1990) recently identified the hybrid as *Catasetum blepharochilum* Schltr. However, this binomial (Schlechter, 1920, 1929) is a synonym of *C. maculatum* Kunth and is not the hybrid described here. According to Dodson (1978), the hybrid origin of *C.* ×*guianense* ". . . was confirmed by later hybridization experiments."

Catasetum ×*guianense* is morphologically intermediate between the two parents. It differs from *C. longifolium* in the larger flower (dorsal sepal to 25 mm long in the hybrid vs. 15 mm long in *C. longifolium*) and longer antennae (to 7 mm in the hybrid vs. 3 mm in *C. longifolium*). It differs from *C. macrocarpum* in the orientation of the inflorescence (pendent in the hybrid vs. erect in *C. macrocarpum*) and the antennae (bilaterally symmetrical in the hybrid vs. bilaterally asymmetrical in *C. macrocarpum*). The hybrid is probably pollinated by the same euglossine bees that pollinate the parents: *Eulaema bombiformis*, *E. cingulata*, and *E. meriana*. Pollen flow between the parents of this hybrid, as in other *Catasetum* hybrids (e.g., *C.* ×*dunstervillei;* Romero & Carnevali, 1989a), is unidirectional: only the pollinia of *Catasetum longifolium* can pollinate female flowers of *C. macrocarpum* (the pollinia of *C. macrocarpum* are too big to fit in the stigmatic cleft of female flowers of *C. longifolium*). This hybrid has been found on *Mauritia* palms (Dodson, 1978).

Catasetum incurvum Klotzsch, Allg. Gartenzeitung 22: 178. 1854. *Catasetum saccatum* Lindley var. *incurvum* (Klotzsch) Mansf., Repert. Spec. Nov. Regni Veg. 30: 272. 1932. TYPE: Peru. Without precise locality, J. Warscewicz ex hort. Mathieu (holotype, B destroyed; lectotype, here designated, W (Herb. Reichenbach No. 24568, pro parte)). Figures 2, 3B.

Catasetum stupendum Cogn., J. Orchidées 6: 13. 1895. TYPE: Peru. Without precise locality, ex hort. L'Horticulture Internationale (type not located).

Catasetum trautmanii Senghas, Orchidee 41: 216. 1990. Syn. nov. TYPE: Peru. Without precise locality, Dec. 1986, G. Trautmann ex Hort. Botanischer Garten Heidelberg 643 (holotype, HEID not seen).

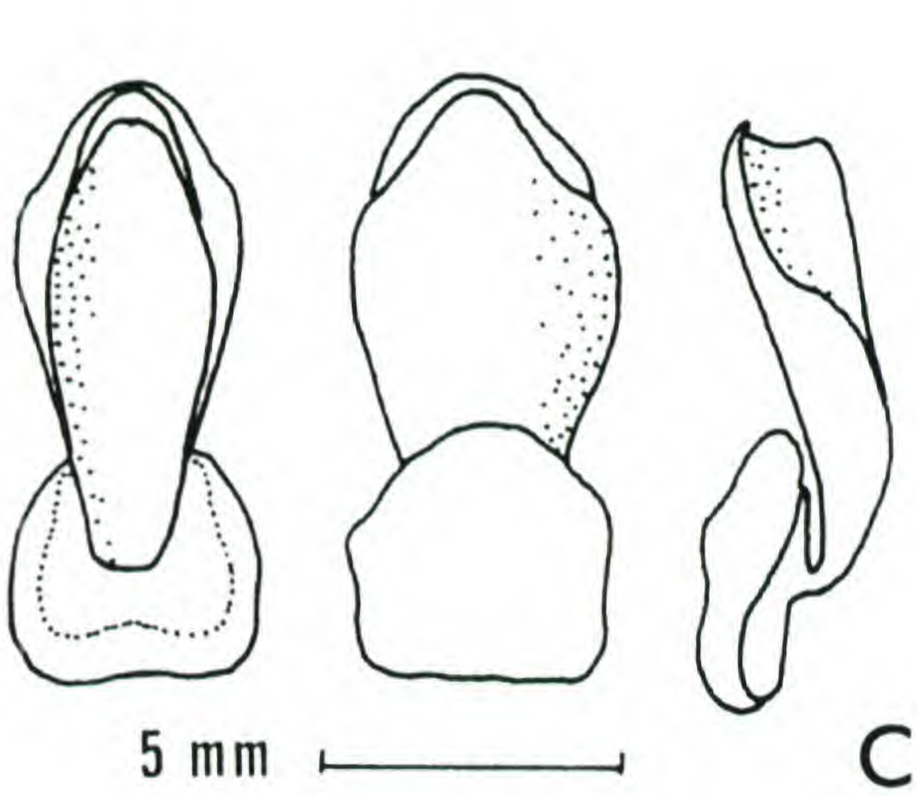
Other specimens examined. PERU. AMAZONAS: La Peca, 1,000 m, 21 Sep. 1963, *F. Woytkowski 2* (AMES, F, K, MO, US), 20 Aug. 1964, *Woytkowski 4* (AMES), 9 June 1966, *Woytkowski 8* (AMES); canyon of the Río Marañon, below Milagro on the Mesones–Muro highway, Quebrada Aramango, 24 June 1966, *P. C. Hutchinson 1547* (BR); canyon of the Río Marañon, between km 247 and 250 of the Mesones–Muro highway, 1959, *Hutchinson 1559* (AMES); Río Utcubamba, 6 km E of Quebrada Honda, km 276 E of Olmos, 26 Aug. 1966, *Hutchinson & J. K. Wright 6776* (AMES); Río Utcubamba Canyon, 1,800 m, 6 Apr. 1965, *F. Antich s.n.* (AMES); vicinity of Campamento Ingenio 1–3 km up road to Pomacocha (and Rioja), 1,300–1,400 m, 27 Jan. 1964, *Hutchinson & Wright 3836* (AMES).

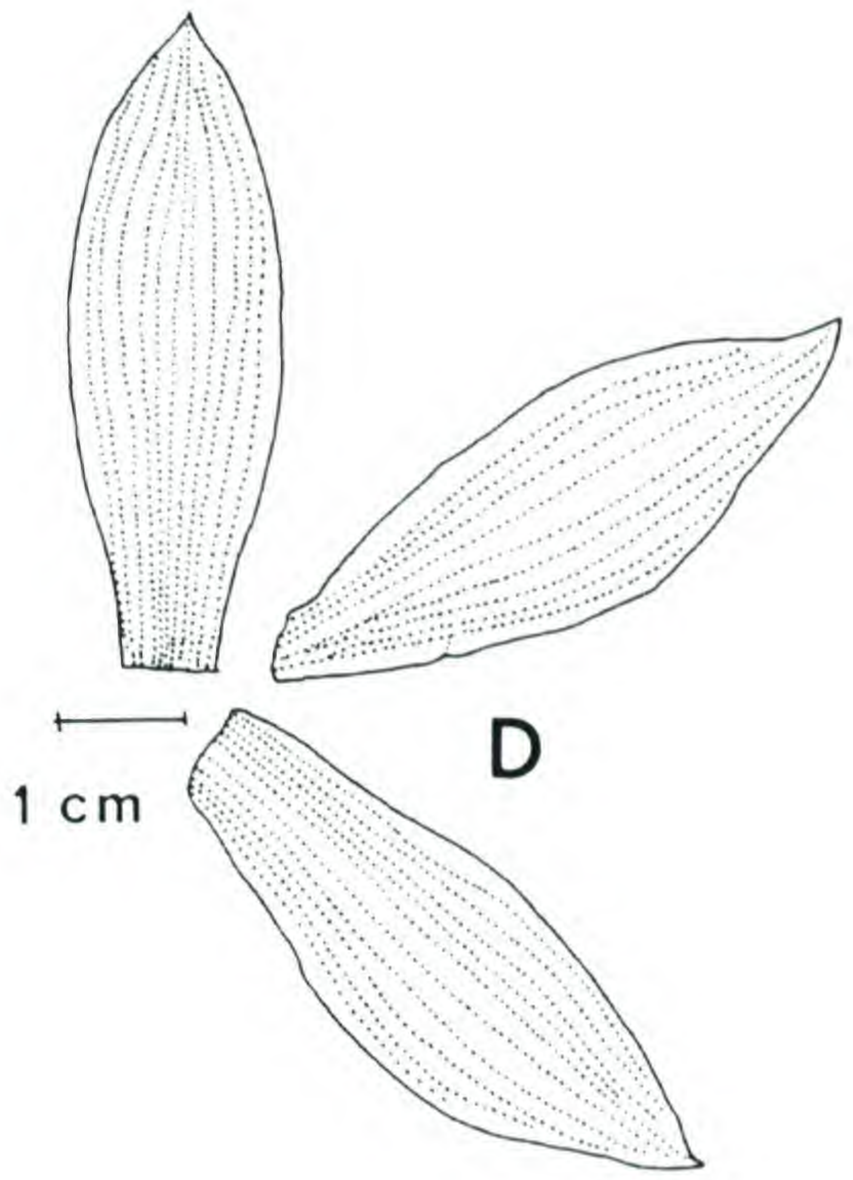
Catasetum incurvum has been treated as a variety of *C. saccatum*. However, we believe this taxon should be recognized at the rank of species based on its larger size and the shape of the labellum (Lindley, 1855). Furthermore, *C. incurvum* is restricted to mid- to high-altitude rainforests (600–1,800 m) in the Peruvian Amazon, whereas *C. saccatum* is widespread in lowland forests (below 500 m) in the Guianas, Brazil, Ecuador, Peru, and Bolivia. The holotype of *C. incurvum* was presumably destroyed during the bombing of Berlin. Fortunately, Reichenbach made a drawing of one of the flowers described by Klotzsch during one of his visits to this important herbarium. This drawing is selected as lectotype (Fig. 3B).

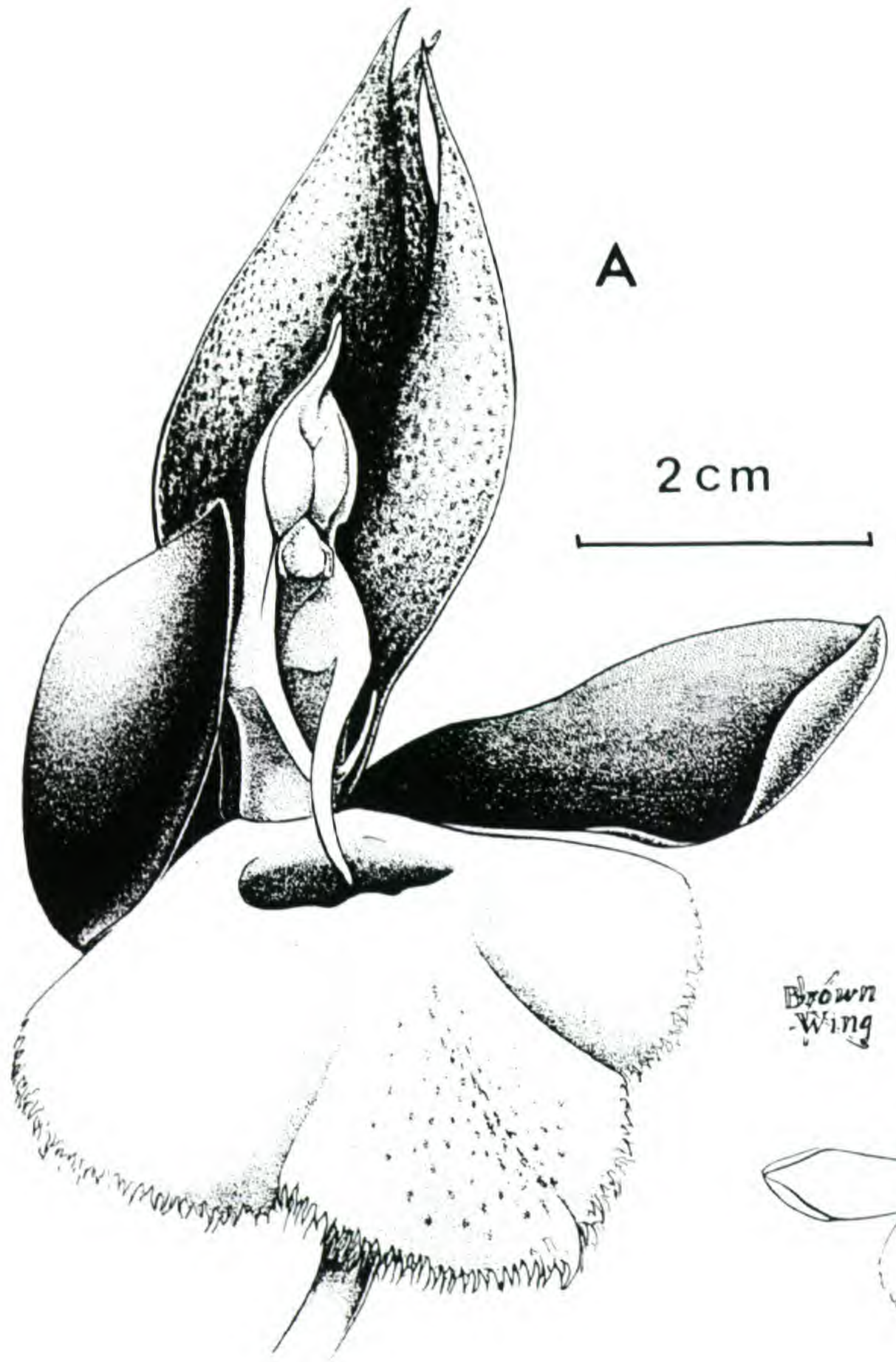
Catasetum macroglossum Reichb. f. Gard. Chron. n.s. 8: 552, 1877. TYPE: Ecuador. May 1877, ex hort. Strickland (lectotype, here designated, W (Herb. Reichenbach No. 38701)).

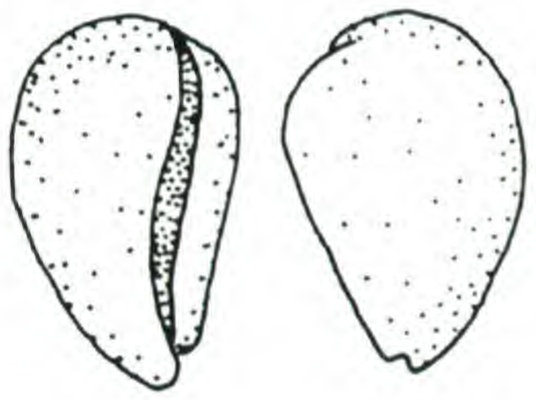
Other specimens examined. ECUADOR. LOS RIOS: km 56 Quevedo–Santo Domingo, Río Palenque Biological Station, 150–220 m, 6 Mar. 1974, *Dodson 5491;* Quevedo, 700 m, 5 June 1978, ex hort. Marie Selby Botanical Gardens, *Dodson 3236* (SEL). GUAYAS: near Bucay, 150 m, 28 Aug. 1978, ex hort. Marie Selby Botanical Gardens, *Dodson 3235* (SEL); El Progreso, Guayas, 14 Aug. 1940, ex hort. Puerto Rico Experimental Station, *A. G. Kerorkian 6199* (AMES).

Reichenbach included several "varieties" of *C. macroglossum* in his protologue ("I have had them ochre coloured, with green sepals and petals, quite light green, dark green, light yellow, dark yellow, and brownish purple. I have seen it rather frequently, first from Messrs. Veitch, at different times from Mr. Day, and then from Sir C. W. Strickland, and various other correspondents since last November"). Among these varieties were several representatives of the natural hybrid between *C. macroglossum* and *C. expansum*, as well as what we currently know as *C. macroglossum* (Dodson, 1962: 52, fig. 10; Dodson & Dodson, 1980; Arosemena et al., 1988:









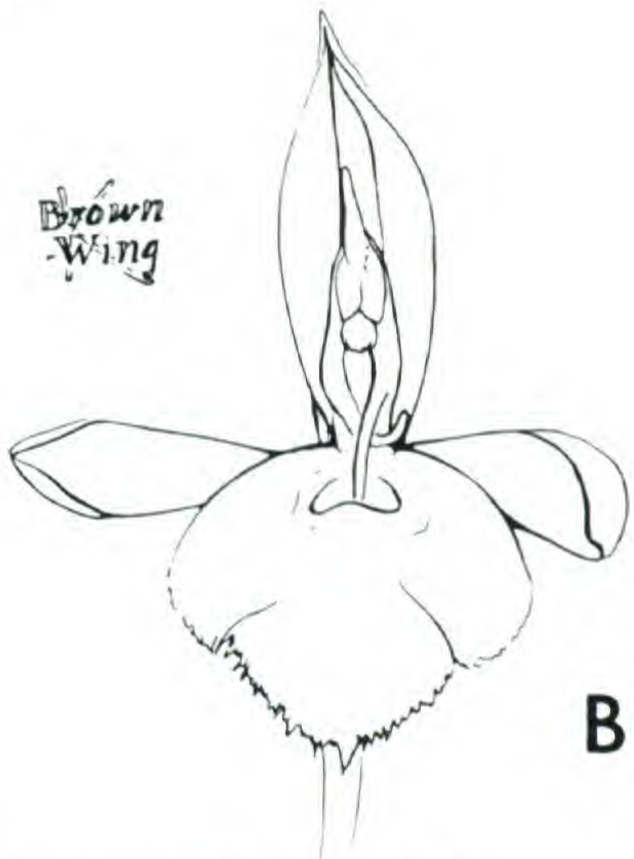


Figure 2. *Catasetum incurvum* Klotzsch. —A, B. Side and front view of staminate flower. —C. Pollinarium (pollinia removed). —D. Sepals and petals. —E. Pollinium. (A–E drawn from *Hutchinson & Wright 3836.*)

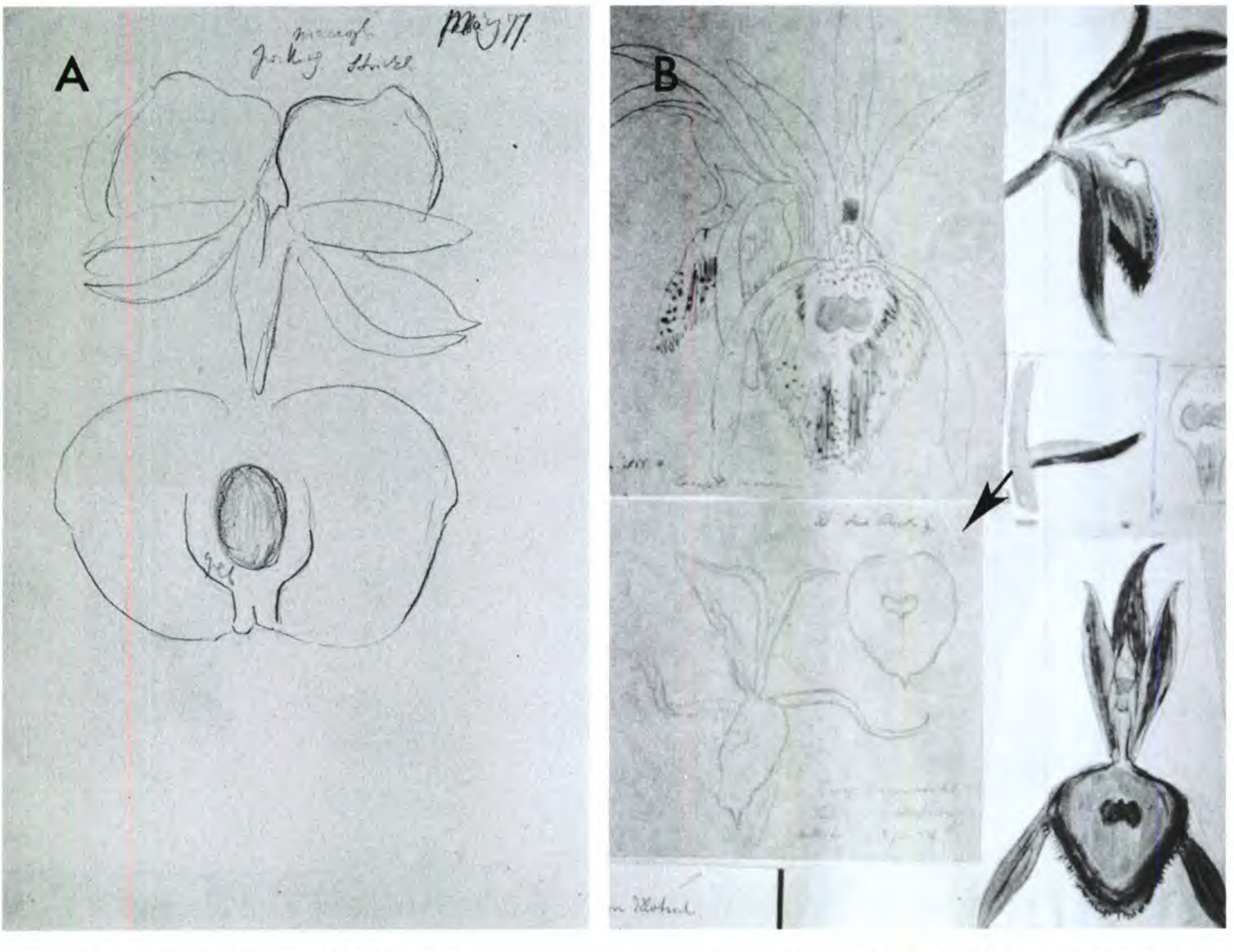


Figure 3. —A. Lectotype of *Catasetum macroglossum* (from Herb. Reichenbach 38701.) —B. Lectotype of *Catasetum incurvum* Klotzsch (from Herb. Reichenbach 24568).

37, fig. 38). Reichenbach annotated at least two specimens as *C. macroglossum* in his herbarium without designating a type. We have chosen a lectotype (Fig. 3A) that maintains the currently accepted concept of *C. macroglossum*. There are six paintings of "*Catasetum macroglossum*" in John Day's scrapbooks (K). Of these, only one corresponds to our current concept of *C. macroglossum* (Book 20: 51, December 1876, as *Catasetum macroglossum* var. *viridi-pallens*). The other five depict different forms of *C.* ×*sodiroi* (Book 20: 79, 1 Feb. 1877; Book 20: 81, 3 Feb. 1877; Book 21: 61, 18 Nov. 1879; Book 23: 13, 26 Dec. 1876; Book 23: 59, 22 Apr. 1878).

Catasetum ×sodiroi Schltr. (pro sp.)

Catasetum sodiroi Schltr., Repert. Spec. Nov. Regni Veg. Beih. 8: 91. 1921. TYPE: Ecuador. Chimborazo: in silvis tropicis, Puente de Chimbo (holotype, B destroyed). Ecuador. Road Guayaquil–Quevedo, ca. km 78, 30 m, 5 Apr. 1960, *Dodson 38* (neotype, here designated, SEL; isoneotypes, MO, SEL).

Catasetum trilobatum Senghas, Orchidee 41: 218. 1990. Syn. nov. TYPE: Ecuador. Cotopaxi: near Pucayacu, ca. 600 m, W. Rauh ex hort. Botanischer Garten Heidelberg 34459 (holotype, HEID).

Other specimen examined. ECUADOR. GUAYAS: Palestina, 70 m, 6 July 1978, ex Hort. Marie Selby Botanical Gardens, *Dodson 3234* (SEL).

Dodson (1962) proposed *Catasetum macroglossum* Reichb. f. and *C. expansum* Reichb. f. as the parents of this hybrid swarm, providing solid evidence to support his hypothesis. We selected *Catasetum sodiroi* as the earliest name because plants collected in the type locality of *C. sodiroi* Schltr. (currently known as Bucay) bear flowers that resemble the natural hybrid (C. H. Dodson, pers. comm.). A neotype was chosen because a search of those herbaria with known Sodiro's collections (BP, BR, K, MO, NY, Q, QPLS, US) failed to produce authentic material of *Catasetum sodiroi*.

As in the case of *Catasetum* ×*tapiriceps* Reichb. f. (Romero & Carnevali, 1989b, 1990), *C.* ×*sodiroi* exhibits a wide range of variation in flower morphology, resupination, and color. It should be emphasized, however, that ". . . a nothotaxon is circumscribed so as to include all individuals (as far as

they can be recognized) derived from the crossing of representatives of the stated parent taxa (i.e., not only the F_1, but subsequent filial generations, and also back-crosses and combinations of these)" (Greuter, 1988: 83, article H.4.1). Thus, the name *Catasetum* × *sodiroi* Schltr. applies to the entire hybrid complex, regardless of its morphological variability. The hybrid differs from *C. expansum* in the labellum that is generally trilobate (vs. entire in *C. expansum*) or hooded (vs. open, cup-shaped in *C. expansum*). It differs from *C. macroglossum* in the resupinate flowers (vs. nonresupinate in *C. macroglossum*), the presence of a conspicuous, triangular callus in the labellum (vs. a semicircular callus in *C. macroglossum*), and the yellow spotted with red to orange color of the flowers (vs. green to greenish yellow in *C. macroglossum*). Both the hybrids and the parents are pollinated by *Eulaema cingulata*, *E. meriana*, and *E. speciosa* (Dodson, 1962). Color photographs of the hybrids may be seen in Arosemena et al. (1988, cover and pp. 27–36).

Catasetum ×violascens Reichb. f. & Warsc. (pro sp.)

Catasetum violascens Reichb. f. & Warsc., Bonplandia 2: 97. 1854. TYPE: Peru. Sources of the Marañon, May 1853, *J. von Warscewicz 14*, (lectotype, designated here, K). Figure 4.

Other specimen examined. PERU. Moyobamba, *G. Monnier 1030* (AMES).

In 1854, Josef von Warscewicz sent several shipments of plants collected in Peru to horticultural houses in Europe. As in the case of *Catasetum macroglossum*, some of the collections included a *Catasetum* natural hybrid and one of its parents. The parent was first described as *Catasetum incurvum* by Klotzsch from a plant cultivated in Germany (see *C. incurvum* above). Lindley used the name *Catasetum secundum* in his herbarium and in one of Warscewicz's catalogs, but the binomial was never validly published. Reichenbach and Warscewicz later described this collection as *C. violascens*. *Catasetum* ×*violascens* is similar to *C.* ×*dunstervillei* G. Romero & Carnevali, a natural hybrid between *C. pileatum* and *C. discolor* (Romero & Carnevali, 1989a, 1991). This similarity reveals a well-established pattern in the inheritance of certain characters in *Catasetum* hybrids: crosses between species in subgenus *Pseudocatasetum* (with minute antennae, usually under 3 mm long) and species in section *Catasetum* (with bilaterally asymmetric, long antennae, usually over 15 mm long) produce progeny with short, stout, bilaterally symmetric antennae. We propose *C. incurvum* (Fig. 2) and *C. discolor* as putative parents based on the following evidence: (1) the morphology of the hybrid (intermediate between the proposed parent species) including the shape of the antenna mentioned above; (2) they are the only possible species in the known range of the hybrid capable of producing such an intersubgeneric hybrid.

Catasetum ×*violascens* differs from *C. discolor* in the conspicuous antennae (vs. inconspicuous in *C. discolor*) and the resupinate staminate flowers (vs. nonresupinate in *C. discolor*). It differs from *C. incurvum* in the parallel, stout antennae (vs. long, slender, bilaterally asymmetrical antennae in *C. incurvum*) and the much smaller flowers (compare Figs. 2 and 4). Plants of *Catasetum* ×*violascens* were found on the side of a road, growing with grasses in clay soils (G. Monnier, pers. comm.). This growth habit is probably inherited from *C. discolor*, also a terrestrial species: *Catasetum incurvum* is always epiphytic. Little is known about the pollinator(s) of the hybrid or the putative parents except that in Venezuela and the Guianas *C. discolor* is pollinated by *Eulaema bombiformis*, *E. cingulata*, and *E. meriana* (Dodson, 1978; G. A. Romero, unpublished data).

A single flower of Warscewicz's original material found at K is here designated as lectotype for *Catasetum violascens;* a tracing of this flower was found in Vienna (Herb. Reichenbach No. 24609, upper right corner). What appears to be the original of Warscewicz's drawing 14 is at W (Herb. Reichenbach No. 24628) and a tracing of it at K.

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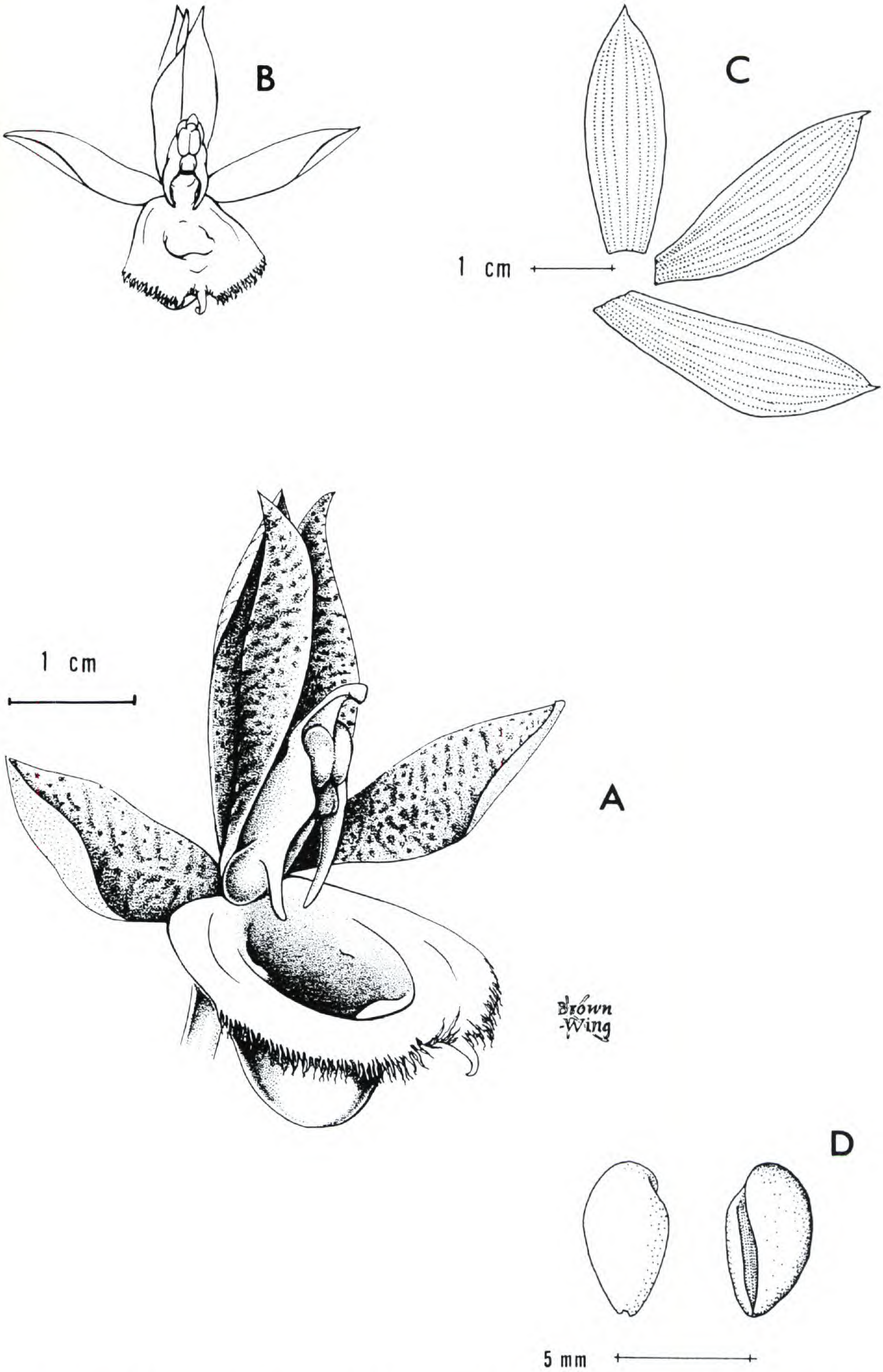

Figure 4. *Catasetum* ×*violascens* Reichb. f. & Warsc. —A, B. Side and front view of staminate flower. —C. Sepals and petals. —D. Pollinium (A–D drawn from *G. Monnier 1030.*)

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Taxonomic Notes on Mesoamerican *Annona* Section *Atta* (Annonaceae), Including *Annona pruinosa* sp. nov.

George E. Schatz
Missouri Botanical Garden, P.O. Box 299, St. Louis, Missouri 63166-0299, U.S.A.

ABSTRACT. A new species of *Annona* sect. *Atta* from the upper altitudinal limit of the Pacific dry forest of Nicaragua and Costa Rica is proposed based upon a distinctive abaxial leaf epidermis. In addition, the analysis of flowers discovered for *Annona longipes* necessitates its transfer to section *Atta*.

During preparation of treatments of the Annonaceae for the *Flora de Nicaragua* and the *Manual to the Plants of Costa Rica*, a new species of *Annona* L. sect. *Atta* C. Martius has been identified based on material from Nicaragua and Costa Rica. In addition, recent flowering collections of *Annona longipes* Saff. from Veracruz, Mexico, reveal its incorrect placement by Safford (1913) in section *Pilannona* Saff., and indicate its proper placement in section *Atta*.

Annona (section *Atta* C. Martius) **pruinosa** Schatz, sp. nov. TYPE: Nicaragua. Carazo: Finca de Minco Cabrales, 700 m al sur del reloj, 18 June 1982 (fl, fr), *L. Reyes V. 64* (holotype, MO; isotype, HNMN). Figure 1.

A speciebus aliis Annonae sectionis Attae laminis subtus pruinosis differt.

Tree to 10 m tall; young branches very sparsely white-tomentose, at length glabrescent. Petiole 0.8–1.3 cm long, slender, deeply canaliculate, very sparsely tomentose, drying black; lamina chartaceous, elliptic to obovate-elliptic, 6.4–15 cm long, 3.2–8.3 cm broad, the base cuneate to obtuse, the apex acute to rounded, the upper surface glabrous, the lower surface granular pruinose and initially sparsely white-puberulous, at length glabrescent, the venation eucamptodromous with 9–14 secondary veins per side, the primary vein slightly impressed adaxially, prominently elevated and sparsely golden puberulous, as are the slender secondary veins, abaxially. Flowers solitary, terminal but appearing leaf-opposed or supra-axillary by displacement during growth of the renewal shoot; pedicel slender, 1.3–2.4 cm long, to 3.1 cm long, 0.2 cm diam. and becoming rigid in fruit, white-tomentose, bearing a minute bract 0.8–0.9 cm from the base; sepals triangular, 0.2–0.3 cm long, 0.3 cm broad, the apex acute, densely white-tomentose; petals 3 (the outer petal whorl only, the inner whorl absent or at most represented by tiny vestigial petals), fleshy, triquetrous, narrowly oblong-elliptic, 1.8–2.4 cm long, 0.5–0.8 cm broad, the apex acute to obtuse, the base concave inside, the outer surface white-sericeous toward the base, becoming sparsely puberulous toward the apex, the inner surface densely tomentose; stamens numerous, 1 mm long, the connective expanded truncate discoid, minutely papillose, yellow, contrasting with the white thecae; carpels 25–36. Fruit syncarpous, subglobose to broadly ovoid, to 4.5 cm long, to 4.5 cm diam., the apex rounded, the surface initially areolate, but then smooth with no evidence of the individual carpels at maturity, green, or light and dark green mottled, initially puberulous, at length glabrescent; seeds flattened ellipsoid-obovoid, to 1.6 cm long, 0.9 cm broad, 0.6 cm thick, the seed coat very thin, smooth-reticulate, light brown.

Paratypes. COSTA RICA. GUANACASTE: Parque Rincón de la Vieja, Hacienda Santa María, sendero a las pailas, 10°48′N, 85°10′W, 700–800 m, 13 Aug. 1987 (fr), *G. Herrera 693* (CR, MO); El Mirador, Río Negro, 10°47′40″N, 85°18′35″W, 1 Oct. 1990 (fr), *G. Rivera 679* (CR, MO). PUNTARENAS: San Luis, Monteverde, Río Guacimal, 10°16′N, 84°49′W, 700 m, 24 June 1988 (fr), *Bello et al. 24* (CR, MO, U), Cantón de Puntarenas, Monteverde, cliff edge on Pacific slope, Bajo Tigre trail, 10°18′N, 84°48′W, 900 m, 20 Oct. 1990 (fr), *Haber & Zuchowski 10110* (CR, MO), 27 Dec. 1991 (fr), *Schatz et al. 3230* (MO). NICARAGUA. CHONTALES: ca. 2.8 km above (N of) Cuapa, ca. 12°17′N, 85°23′W, 400–500 m, 4 Sep. 1977 (fr), *Stevens 3634* (HNMN, MO, WIS); 2–3 km NE of Cuapa, 12°17′N, 85°22′W, 400 m, 24 Sep. 1983 (fr), *Nee & Sebastian 28486* (HNMN, MO, WIS). BOACO: Las Pitas, carretera a Camoapa (No. 19), 12°28′N, 85°35′W, ca. 400 m, 29 Aug. 1981 (fr), *Moreno 10651* (HNMN, MO).

Distribution and habitat. Annona pruinosa is known from southern Nicaragua and the Pacific slope of the Tilarán range in northwestern Costa Rica, in moist forest between 400 and 800 m, i.e., the upper altitudinal limit of the Pacific dry forest.

The affinities of *Annona pruinosa* within section *Atta* lie probably with several Caribbean species (*A. urbaniana* R. E. Fries, from Haiti; *A. praetermissa* Fawcett & Rendle, from Jamaica; and *A. cubensis*

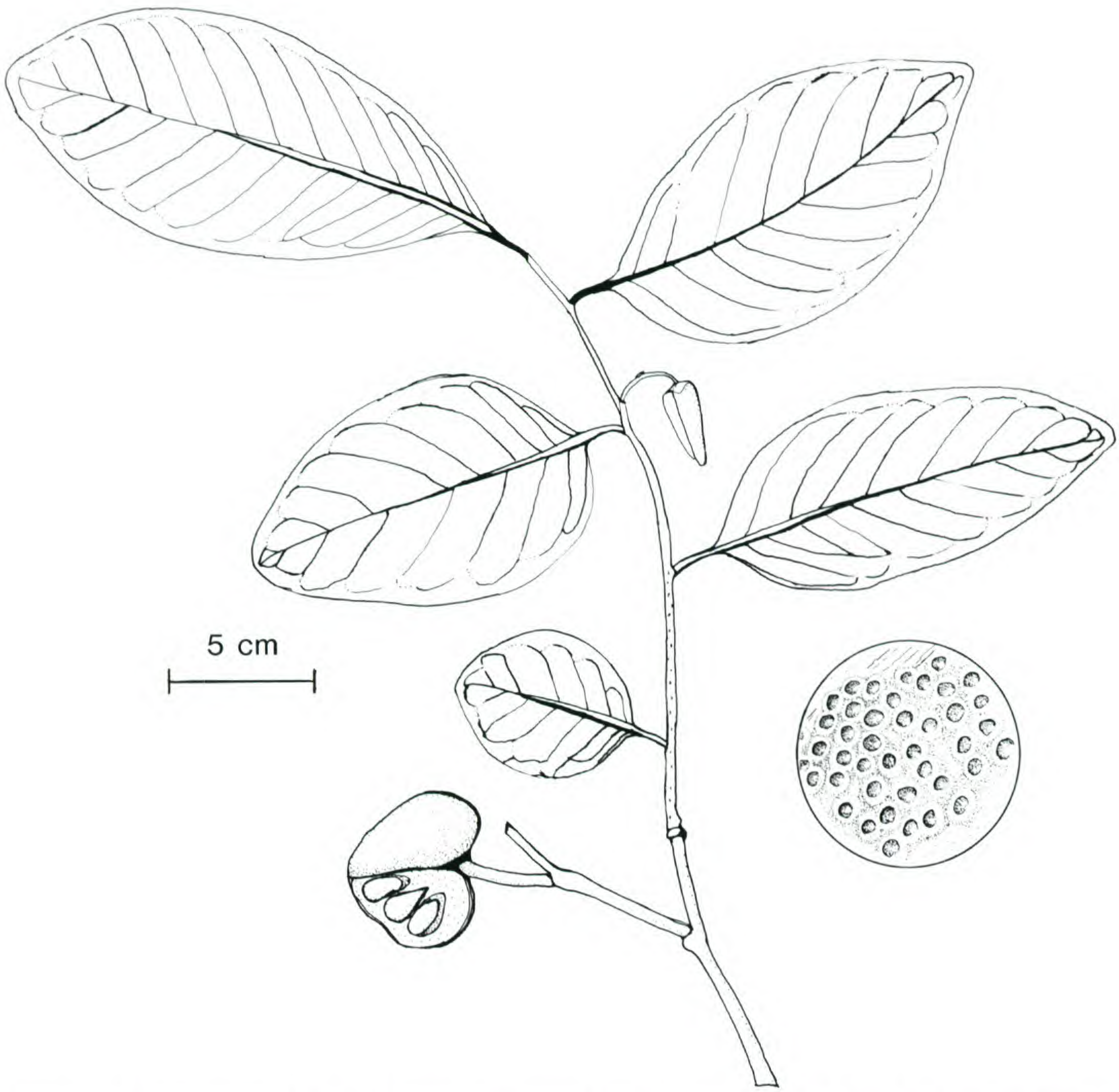

Figure 1. *Annona pruinosa* Schatz, flowering and fruiting branch (from *L. Reyes V. 64*). Inset: magnification of abaxial leaf surface, ×200.

R. E. Fries, from Cuba), all of which possess glaucous leaf undersides. In Costa Rica, collections of *A. pruinosa* have been referred to *A. lutescens* Saff., described from southern Mexico and Guatemala, which, however, possesses a fruit twice as large as *A. pruinosa* and lacks the pruinose leaf underside. *Annona lutescens* is probably better placed in synonymy as merely a broad-leaved variant of *A. reticulata* L.

Annona (section *Atta* C. Martius) **longipes** Saff., Contr. U.S. Natl. Herb. 16(10): 269, pl. 89. 1913. TYPE: Mexico. Veracruz: Cantón de los Tuxtlas, near the outlet of Lake Catemaco, 28 Apr. 1894 (fr), *Nelson 430* (holotype, US; isotype, NY).

Additional specimens examined. MEXICO. VERACRUZ: Laguna Encantada, 2 Nov. 1971 (st), *Beaman 5242* (XAL); 5 km SW of Santiago Tuxtla and Hwy. 180 at bridge over the Río Tepango (Río Grande), 18°27′N, 95°19′W, 160 m, 14 Dec. 1985 (fl), *Nee 32131* (NY, WIS, XAL), 5 Apr. 1983 (fl, fr), *Nee & Taylor 26490* (F, WIS, XAL), 30 May 1986 (fl, fr), *Schatz & Alverson 1161* (MEXU, U, WIS, XAL).

Although flowers were lacking, Safford (1913) nonetheless confidently assigned *Annona longipes* to his newly circumscribed section *Pilannona*, presumably based on the indument, which, as he acknowledged, is erect in contrast to appressed (sericeous) in *Annona sericea* Dunal and its allies. Nevertheless, he remarked that *A. longipes* lacked a muricate fruit surface, an essential characteristic of other members of section *Pilannona*. Fries (1931:

Figure 2. *Annona longipes*, flowering and fruiting branches (*Schatz & Alverson 1161*).

245–246) followed Safford in retaining *A. longipes* in section *Pilannona*, stating that "Da indessen die Blüten nicht bekannt sind, kann die Stellung der Art nicht mit voller Sicherheit angegeben werden" [insofar as the flowers are unknown, the position of the species cannot be determined with complete certainty].

Flowers remained unknown until 1983, when Nee & Taylor (*26490*) re-collected *A. longipes* near Santiago Tuxtla. In contrast to the broadly ovate outer petals of species in section *Pilannona*, *A. longipes* possesses outer petals typical of species in section *Atta*, i.e., distinctly keeled on the inner surface or triquetrous (Safford, 1914) (Fig. 2). Within section *Atta*, *A. longipes* is most closely related to several species with similar indument, including *A. longiflora* S. Watson from western Mexico, and the cultivated *A. cherimola* Miller, probably native to Ecuador. As such, *A. longipes* holds promise for possible hybridization with *A. cherimola* in the development of a second lowland "custard apple" cultivar; the "Atemoya," a hybrid between *A. cherimola* and *A. squamosa* L., has already proven successful in southern Florida. Plants originating from seed of *Schatz & Alverson 1161* are now in cultivation in the Climatron at the Missouri Botanical Garden. Known only from the above-cited collections, *A. longipes* is apparently rare in the wild. Its range appears to fall within the rain shadow of the coastal Los Tuxtlas volcanic peaks, and therefore, climatically within a somewhat drier phase of "Selva Alta Perennifolia," which has now largely been converted to pasture and agriculture.

Acknowledgments. I thank M. Nee for directing me to *Annona longipes*, W. Haber for showing me *Annona pruinosa*, and J. Myers for assistance with the illustration.

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Croton ascendens (Euphorbiaceae), a New Liana from Eastern Amazonia

Ricardo de S. Secco and Nelson A. Rosa
Museu Paraense Emílio Goeldi, Depto. de Botânica,
Cx. Postal 399, 66.040, Belém, Pará, Brazil

ABSTRACT. A new species, *Croton ascendens*, is described as the second liana in its genus from South America. The new species is distinguished from *Croton pullei*, the other liana in the genus described from Surinam, by its palmately lobed leaves, bisexual racemes in inflorescences, and slightly cucullate linear-spatulate petals of staminate flowers. *Croton ascendens* is placed in section *Croton*, subsection *Croton*.

Croton L. is one of the largest genera in number of species (ca. 1,000 according to Webster & Burch, 1967) of the Euphorbiaceae, and is in urgent need of careful revision. It was last studied comprehensively by Mueller (1866, 1873). Although a natural group, the genus displays considerable polymorphism. The majority of species occur in the West Indies and South America, and their identification is very difficult. Recent papers on South American *Croton* (Lanjouw, 1931; Croizat, 1940, 1941, 1944; Jablonski, 1965) have not included the identification of the large number of herbarium specimens currently available in Amazonian herbaria (IAN, INPA, MG). Mueller's treatments (1866, 1873) give some help, but unfortunately they are out of date.

As part of ongoing research on the Euphorbiaceae of Amazonia, the authors are currently concentrating on the genus *Croton*. Fieldwork in Paragominas, Pará, Brazil has yielded a new species of liana, which is herein described.

Croton ascendens R. Secco & N. A. Rosa, sp. nov. TYPE: Brazil. Pará: Paragominas, Fazenda Vitória, 10 Apr. 1989, *Rosa & Uhl 5212* (holotype, MG; isotypes, K, MO, U). Figure 1.

Liana monoica, pilis stellatis vestita. Folia 3-lobata ad basin cordata. Inflorescentia bisexualis ex racemo glomerulorum constans. Flores masculini numerosi; calyce 5-lobato pilis stellatis obtecto; receptaculo piloso; petalis 5 liberis, lineari-spathulatis ad apicem cucullatis; staminibus 11, eorum 10 basi connatis, uno libero centralique. Flores feminei 1–3 in partibus basalibus medianisque racemi cum floribus masculinis nonnullis commixti; calyce 5-lobato; ovario subgloboso, stellato-pubescenti, disco undulato styloque 6-ramoso instructo.

Liana climbing on shrubs or trees, monoecious. Leaves alternate, chartaceous, trilobate, the lobes acute or acuminate, 15–20 cm long, 10–19 cm wide, with stellate hairs on both surfaces, glands irregularly distributed on the abaxial side, and toward the apex on the adaxial side, base cordate, with 5 pairs of lateral veins, veins prominulous on the abaxial side, petiole 5–11 cm long, cylindric, with two flat glands at the apex, stellate hairs covering the whole surface. Inflorescence a raceme of glomerules, terminal, solitary or geminate, bisexual, pistillate flowers 1–3 basal and medial, mixed with some staminate flowers, staminate flowers in glomerules along most of the rachis. Staminate flowers numerous, pedicels slender, 2 mm long, stellate-lepidote, calyx 5-lobate, lobes sagittate, stellate-lepidote without, glabrous within; receptacle pilose; petals 5, free, ca. 5 mm long, linear-spatulate, slightly cucullate at the apex, pilose; stamens 11, 10 connate basally, one free central, 5–5.5 mm long, with abundant long, silky hairs, disc 5-glandular. Pistillate flowers fewer, pedicels subulate, 2.5 mm long, stellate-lepidote, calyx 5-lobate, slightly connate at base, lobes acuminate, stellate-lepidote hairs outside, long silky hairs inside at the apex of the lobes; ovary subglobose, tricarpellate, ca. 2 mm long, 2.5 mm wide, with stellate hairs, disc undulate, with long and silky hairs, the styles 6 times bifid, 3–5 mm long, with long stellate hairs, apex glabrous. Fruit seen only in an early stage.

Distribution. Known only from mata de terra firme (Amazon forest) and capoeira of Paragominas, in Pará, Brazil.

Vernacular name: Algodão bravo (*Rosa & Uhl 5212*).

Paratype. BRAZIL. PARA: Paragominas, Fazenda Vitoria, 8 Oct. 1990, *Secco et al. 781* (MG).

Lianas are uncommon within *Croton*. Lanjouw (1931) described *Croton pullei* from Surinam, indicating it as the first species of the genus with this habit. He later (1939a) described variety *glabrior*, indicating that, according to the collector Rombouts,

Figure 1. *Croton ascendens* (*Rosa & Uhl 5212*). —A. Habit with inflorescence showing staminate and pistillate flowers. —B. Staminate flower, without petals and central stamen. —C. Central stamen. —D. Staminate petal. —E. Pistillate sepals, abaxial view on left, adaxial on right. —F. Ovary.

this was a tree. Likewise, he suggested that *C. pullei* must be a tree and that the annotation made by its original collector, Stahel, must have been a mistake, as no species of *Croton* were known to be lianas. Lanjouw (1939b) published a correction for the habit of *C. pullei* as follows: "page 34, line 15, instead of 'Scandent shrub' read: 'tree or shrub (scandent?)'." However, recent studies on Amazonian

TABLE 1. Comparison of morphological characters of *Croton ascendens* and *C. pullei*.

C. ascendens	*C. pullei*
Palmately lobed leaves	Unlobed pinnately veined leaves
Inflorescence raceme of glomerules bisexual; pistillate flowers basal and medial; staminate flowers along most of the rachis	Inflorescence unisexual, racemose, the pistillate ones a simple raceme, the staminate ones a raceme of glomerules
Petals of staminate flowers linear-spatulate, slightly cucullate at the apex	Petals of staminate flowers obovate

Croton made by the senior author confirm that *C. pullei* is really a liana.

The affinities of *Croton ascendens* are not entirely clear, since no species closely resembling it has been found among the large collection of Amazonian *Croton* at the herbaria of MG, IAN, and INPA, and South American *Croton* (including Brazil) at the herbaria of RB, R, and SP. Although a liana, *C. ascendens* is quite different from *C. pullei*, especially in the characters cited in Table 1.

Because the female flower of *C. pullei* from the analyzed collections (*Stahel 76*, holotype, U) is in an early stage, it is difficult to compare its morphological characteristics with those of *C. ascendens*.

Croton ascendens is placed in section *Croton* subsect. *Croton* because of the bisexual lower cymules, the pentamerous, equal-lobed calyx in both the staminate and pistillate flowers, and the pilose receptacle of the staminate flowers.

Acknowledgments. The senior author expresses appreciation to the Conselho Nacional de Desenvolvimento Científico e Tecnológico (CNPq) for a research grant (no. 301.252/86-ZO-FV) to study the Euphorbiaceae; to Enrique Forero and David Brunner, Missouri Botanical Garden (MO), for the translation of the text from Portuguese to English; to William Rodrigues (INPA, Manaus) for the Latin diagnosis; to Christopher Uhl, (EMBRAPA, Belém) for logistical support; to José Maria Albuquerque, Ana Rita Alves, and William Overal, for suggestions on the manuscript; to the curator of the Utrecht Herbarium (U) for loan of the type material of *Croton pullei* Lanj.; to Raphael Alvarez for his illustration of the habit of the species; to the reviewers for important comments on the manuscript; and to Celso Moraes for assistance in preparing the manuscript on diskette.

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Ozobryum ogalalense (Pottiaceae), a New Moss Genus and Species from the American Great Plains

G. L. Smith Merrill
Division of Biology, Kansas State University, Manhattan, Kansas 66506-4901, U.S.A.

ABSTRACT. Among the bryophytes collected in northwestern Kansas by Vernon L. Wranosky of Colby, Kansas, during the summer of 1990 is a new genus and species of Pottiaceae, *Ozobryum ogalalense*. Subsequent collecting in the vicinity has resulted in two additional localities for this moss, one in Kansas and one in Nebraska.

Ozobryum ogalalense Merrill, gen. et sp. nov. TYPE: U.S.A. Kansas: Decatur County, on Ogallala Formation mortarbeds above south fork of Sappa Creek, 25 km SW of Oberlin, 39°40′N, 100°43′W, ca. 800 m, 11 Aug. 1990, *Wranosky 62* (holotype, KSC; isotypes, DUKE, MICH, MO). Figures 1, 2.

Planta insignis foliis obtusatis margine incrassatis quasi succulentis, cellulis utroque folii paginae grosse mamillosis, costa debili obscura utrinque cellulis mamillosis occulta bene distincta.

Plants minute, growing in soft, compact cushions, to 2 cm high, dark green to yellowish green at surface of tufts, without a central strand. Leaves erect when dry, spreading at 45° or less when moist, concave, oblong-elliptic, rounded at the apex, 0.35–0.55 mm long, margins plane or erect. Costa ending well below the apex, thin and obscure, with 2 guide cells but no stereids, covered on both surfaces by short, bulging-mamillose cells similar to those of the lamina. Upper leaf cells bistratose (or 3-stratose) at the margins and in patches internal to the margins, rounded-hexagonal to subquadrate, ca. 7–9 μm, green and obscure, bulging on both surfaces, crowned with a broad, circular, knoblike thickening of the outer wall, centered over the lumen. Basal cells hyaline and subquadrate in a short area. Archegonial buds scattered along the stem, sometimes easily detached, with a tuft of rhizoids at the base. Perichaetial leaves smooth, ovate, acuminate, entire to unevenly serrate, the costa ending in the apex. Perigonia not seen.

Paratypes. U.S.A. KANSAS: Decatur County, type locality, 30 Apr. 1991, *Merrill 12888*; on N-facing mortarbed cliffs, "Elephant Rock," 2.5 km S of Traer, 30 Apr. 1991, *Merrill 12903*; Rawlins County, on mortarbeds above N fork of Sappa Creek, 22 km SE of Atwood, 11 Aug. 1990, *Wranosky 69*, 30 Apr. 1991, *Merrill 12901*. NEBRASKA: Hitchcock County, on mortarbeds exposed in arroyo, 17.6 km NW of Herndon (Kansas), 30 Apr. 1991, *Merrill 12919*. Voucher specimens deposited in the Reed Bryophyte Herbarium, Kansas State University Herbarium (KSC).

The genus name *Ozobryum* is derived from "bryum" (moss) and from the fictional Land of Oz, the creation of American author L. Frank Baum, now popularly associated with the Kansas plains. The specific epithet "ogalalense" refers to the Ogallala Formation, named for a locality in southwestern Nebraska. The Ogallala is the principal aquifer throughout most of the High Plains from southern South Dakota to the Texas Panhandle.

The leaves of *Ozobryum* are highly distinctive and are characterized by their oblong-elliptic shape, the leaf cells bistratose and mamillose on both surfaces, and the reduced costa obscured on both surfaces by short mamillose cells. In its soft, dense cushions and habitat beneath ledges and in crevices on moist vertical cliff faces, *Ozobryum* resembles a miniature *Gymnostomum*. Under the hand lens the living plants have a peculiar frosted and succulent appearance due to the mamillose cells and thickened leaf margins (Fig. 2). The perichaetial leaves are strikingly different in shape from the vegetative leaves, the cells rhombic, unistratose, and smooth or only slightly roughened at the extreme apex. The female buds, which are sometimes easily detached and have a tuft of rhizoids at the base, could function as vegetative propagules, as improbable as this may seem. No brood bodies have been observed so far.

At the suggestion of Richard Zander, I examined a series of 154 specimens (BUF) from Mexico and elsewhere representing his concept of *Molendoa sendtneriana* (B. S. G.) Limpr. (see Zander, 1977). The tropical American specimens mostly belong to the lax, glaucous-green, linear-leaved plant that corresponds to *Anoectangium obtusifolium* (Broth. & Par. ex Card.) Grout, illustrated by Crum & Anderson (1981). Among the Mexican specimens, however, are several that resemble *Ozobryum* in their small size, short blunt leaves, and thickened leaf margins.

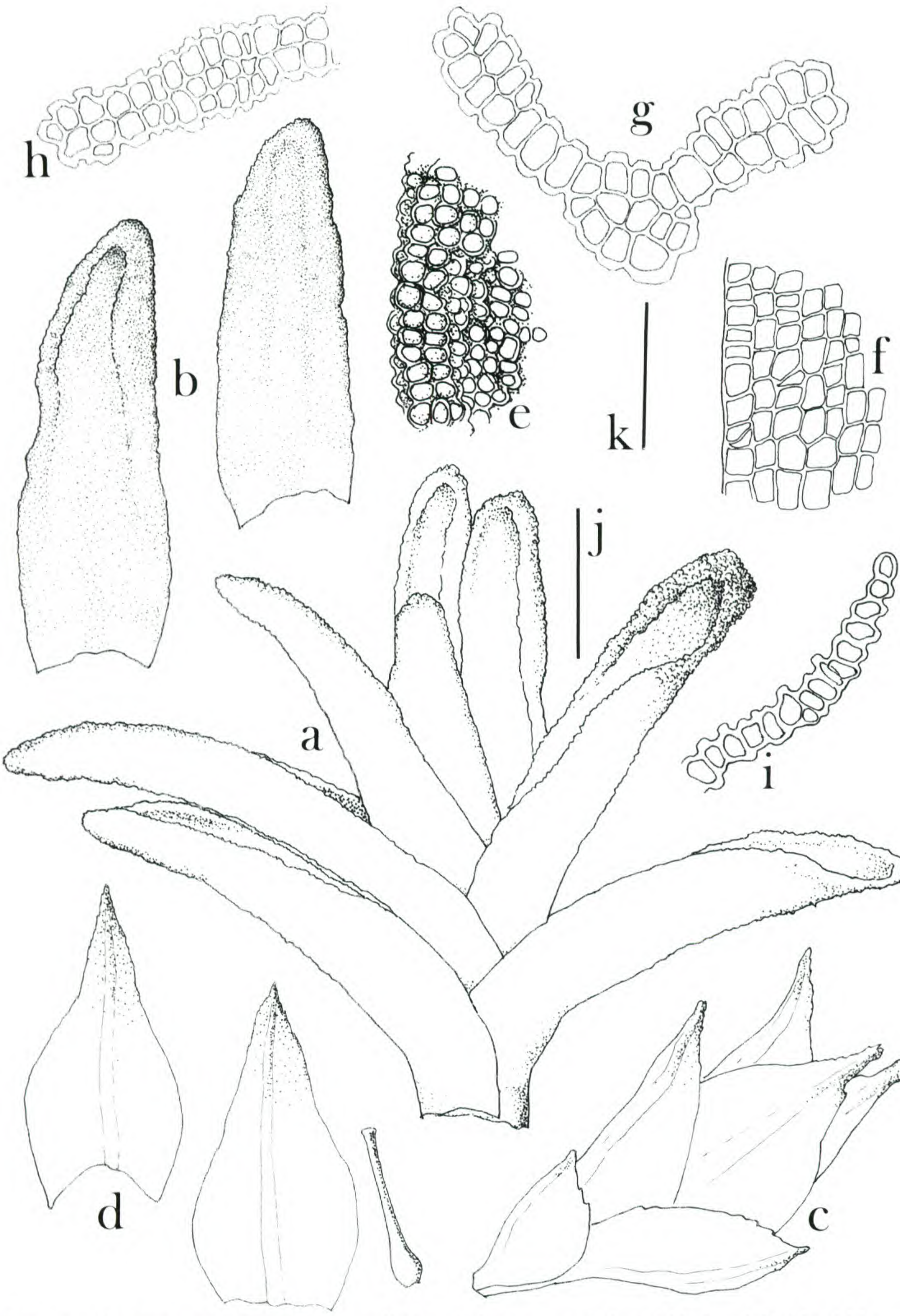

Figure 1. *Ozobryum ogalalense* Merrill. —a. Habit. —b. Leaves. —c. Archegonial bud. —d. Perichaetial leaves and archegonium. —e. Upper leaf cells at margin. —f. Marginal cells near base of leaf. —g. Cross section of leaf in upper third. —h. Cross section of thickened margin of leaf. —i. Cross section of margin near base of leaf. Scales j = 0.2 mm (a–d); k = 0.05 mm (e–i). (All drawings from *Merrill 12888.*)

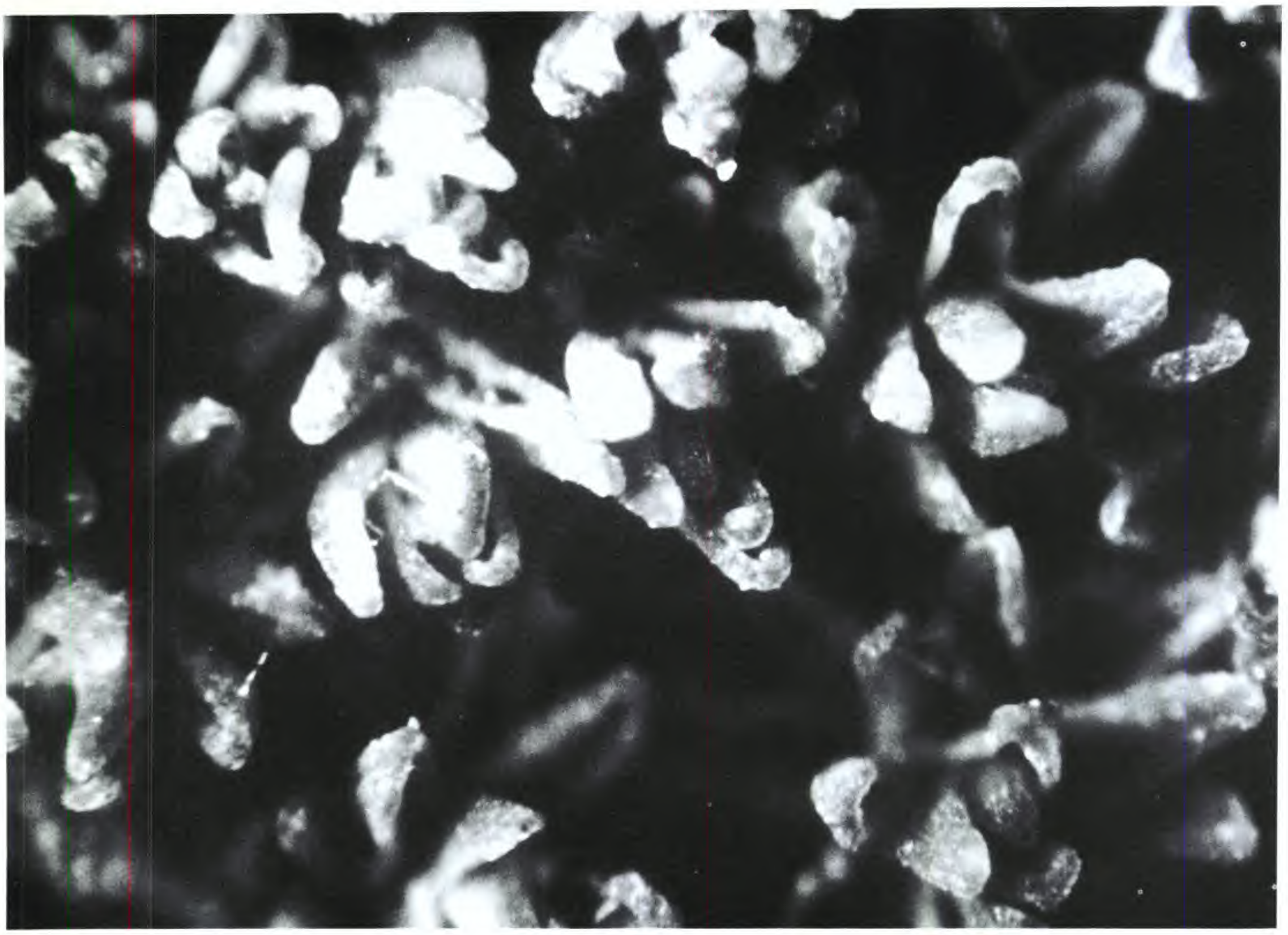

Figure 2. Living plants of *Ozobryum ogalalense* Merrill, from the type locality (*Merrill 12888*); ×90.

The leaf cells of *Ozobryum* are mamillose, and the broad knoblike thickening of the outer cell wall is centered over the lumen. The leaf cells of these small Mexican plants, however, are distinctly cuticular-papillose. There are always several small papillae per cell, and they often extend over the cell wall and onto adjoining cells. The cells at the back of the costa are rather more distinct and elongate, and the costa is not obscured above by bulging cells like those of the lamina. The costa is not strongly developed in these Mexican plants, but all the leaf cross sections examined had a few dorsal stereids in the costa.

The lateral female inflorescences of *Ozobryum* indicate a placement in the subfamily Pleuroweisioideae, thus narrowing the field of potential relationships considerably. The other familiar pleurocarpous genera, *Anoectangium* and *Molendoa*, have distinctly papillose (or rarely almost smooth) leaf cells. Brotherus's drawing (Engler & Prantl, ed. 2) of *Pleuroweisia schliephackei* Limpr. is somewhat suggestive of *Ozobryum* in leaf shape and in habit. However, examination of isotypes (H) of this rare European species reveals that the leaves are also papillose. Moreover, they are unistratose, and the margins are narrowly revolute for most of their length. The fertile branches with their convolute-tubular perichaetial leaves are also distinctive. Zander (1977) distinguished *Molendoa* from *Anoectangium* by the tendency to develop a ventral as well as a dorsal stereid band in the costa. Stereids and a central strand appear to be absent in *Pleuroweisia*, as they are in *Ozobryum*.

The original locality for *Ozobryum* in Decatur County, Kansas, is 36 km south of the Kansas–Nebraska state line and 114 km east of the Kansas–Colorado line. The Rawlins County collection was made about 8 km to the west. "Elephant Rock" is 25 km north, and the Hitchcock County, Nebraska, station is 43 km north of the type locality.

Mortarbeds are arkosic sand and gravel deposits that are partly or completely cemented by calcium carbonate, and are exposed locally as eroded benches or scarps (Walters, 1956). The name is derived from their resemblance to mortar, as well as to their use by early settlers in the area as natural mortar material.

The vegetation of the area is northern grama–buffalo grass prairie (*Bouteloua–Buchloe*), and mixed bluestem–grama prairie (*Andropogon–Bouteloua*)

(Küchler, 1974). The landscape may be described as a gently rolling, treeless plain with eroded rock outcrops (mortarbeds) exposed in low bluffs bordering the principal stream valleys, such as along Sappa and Beaver creeks. Floodplain forest (*Populus–Salix*) is confined to the valley bottoms.

Ozobryum is the second endemic species, and the first endemic genus of mosses to be recorded for the Great Plains. This is of considerable interest since the region is not known for endemism of either bryophytes or vascular plants. *Aschisma kansanum* Andr. is presently known only from south-central Kansas, growing beneath translucent, white quartz pebbles. *Ozobryum* may be more common than these few collections indicate, but its distributional range may be limited to those areas where mortarbeds occur at the surface. The Ogallala Formation is composed primarily of unconsolidated sands and gravels, and mortarbeds are discontinuous and localized (Walters, 1956; Hodson, 1969). Although extending over a huge area, the Ogallala is mostly buried beneath a thick deposit of Pleistocene alluvium and loess, forming a flat, almost featureless surface with poorly developed drainage. In other areas, the Ogallala was entirely removed by erosion prior to the deposit of the overlying loess.

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Notes on *Psychotria* Subgenus *Heteropsychotria* (Rubiaceae: Psychotrieae) in Mexico and Northern Central America

Charlotte M. Taylor
Missouri Botanical Garden, P.O. Box 299, St. Louis, Missouri 63166-0299, U.S.A.

David H. Lorence
National Tropical Botanical Garden, P.O. Box 340, Lawai, Kauai, Hawaii 96765, U.S.A.

ABSTRACT. Expanded descriptions, comments on geographic ranges and infraspecific variation, and complete synonymy are presented for *Psychotria minarum*, *P. galeottiana*, and *P. phanaerandra* (Standley & Steyerm.) Lorence, a new combination made here that is based on *Palicourea phanaerandra* Standley & Steyerm. The new species *Psychotria juarezana* C. M. Taylor & Lorence from southern Mexico is also described.

Psychotria L. is a pantropical genus of about 1,500 species of herbs, shrubs, and small trees. It is represented by three subgenera in the Neotropics. All subtropical species are assignable to subgenus *Psychotria* or subgenus *Heteropsychotria* Steyerm., except *P. microdon* (DC.) Urban. This species was included in subgenus *Psychotria* by Steyermark (1974) and other authors, but is better placed in subgenus *Tetramerae* (Hiern) E. Petit (Hamilton, 1989). Subgenus *Tetramerae* comprises species found in the Palaeotropics, plus this one. It is characterized by leaves that dry pale green, pyrenes with the abaxial ("dorsal") surface smooth except for a median keel, persisting marcescent stipules, and lateral branches in opposite pairs (Hamilton, 1989; Verdcourt, 1976). In contrast, subgenus *Heteropsychotria* is characterized by leaves that dry dark green to brown or gray, pyrenes with three or more ribs on the abaxial surface, stipules that may be persistent or deciduous but are not marcescent, and lateral branches that are usually not opposite. *Psychotria microdon* is found in the Antilles and adjacent continental lowlands, and probably represents an example of long-distance dispersal. Members of subgenus *Tetramerae* characteristically have bacterial nodules in their leaves (Verdcourt, 1976), a feature not found in the neotropical members of *Psychotria* (including *P. microdon*).

The two other subgenera found in the Neotropics encompass at least 500 species. These have been studied in the framework of regional floras but have not been treated comprehensively. The species of subgenus *Psychotria* have recently been treated in-depth for Mexico and Central America (Hamilton, 1989). This is the area of highest diversity for this subgenus, with about 60 species. Subgenus *Heteropsychotria* includes approximately twice as many species in this same area, and many more in South America.

Cephaelis Sw. was studied by Steyermark (1972), who concluded that it comprised an assemblage of species that in many cases were more closely related to various members of *Psychotria* than to other members of *Cephaelis*. He therefore combined *Cephaelis* with *Psychotria* subg. *Heteropsychotria*, making the appropriate combinations for the floras of the Guayana Highlands (Steyermark, 1972) and Venezuela (Steyermark, 1974). Combinations remain to be made for many species that are not found in Venezuela (e.g., Taylor et al., 1991).

A modern infrageneric classification of *Psychotria* subg. *Heteropsychotria* (including *Cephaelis*) was also begun by Steyermark in his South American studies (1972), but was not extended to the Mesoamerican species. Unfortunately, Steyermark's system did not include explicit diagnoses of his groups, but was intended instead "to show apparent relationships between the taxa presented." The flora of northern Mesoamerica includes many of the species Steyermark classified, as well as endemic relatives of these species, so his classification can be extended in general to the region. However, the flora of northern Mesoamerica is not simply a northward extension of the South American flora, but does have its own identity as a phytogeographic province (Takhtajan, 1986); the existing infrageneric classification for subgenus *Heteropsychotria* is inadequate to allow us to classify the species treated here.

We present here expanded descriptions, comments on geographic range and infraspecific vari-

ation, and complete synonymy for several poorly known species of *Psychotria*, and describe and illustrate one new species, *P. juarezana* C. M. Taylor & Lorence. Lists of additional specimens of *P. phanerandra* and *P. galeottiana* examined are available from the authors.

Notes on Previously Described Species

Psychotria minarum Standley & Steyerm., Publ. Field Mus. Nat. Hist., Bot. Ser. 23: 253. 1947. TYPE: Guatemala. El Progreso: between Calera and summit of Volcán Siglo, 2,000–3,300 m, 2 Jan. 1942, *J. A. Steyermark 43106* (holotype, F; isotype, US).

Psychotria lilacina Standley & Steyerm., Publ. Field Mus. Nat. Hist., Bot. Ser. 23: 252. 1947. Syn. nov. TYPE: Guatemala. Huehuetenango: Cerro Huitz, between Mimanhuitz and Yulhuitz, S of Los Cuchumatanes, 1,500–2,600 m, 14 July 1942, *J. A. Steyermark 48564* (holotype, F).

Glabrous to puberulent shrubs to 1.5 m tall, stems becoming terete. *Leaf* blades elliptic, 2–6.5 × 0.7–2.7 cm, acute to acuminate at apex with tip to 2 cm long, acute to obtuse at base, chartaceous, pale abaxially; secondary veins 5–6 pairs, arching, without domatia, sometimes with 1 intersecondary vein perpendicular to costa, midrib and secondary veins smooth adaxially, prominulous abaxially; margins flat; petioles 2–6 mm long; stipules persistent, with truncate circumferential sheath to 0.5 mm long, with 2 lobes on each side, these narrowly triangular, ca. 0.5 mm long, acute. *Inflorescences* terminal, panicle rounded, 3–6-flowered, 1–2 cm long and wide including corollas, erect to deflexed; peduncles ca. 1 cm long; primary branches 1–2 pairs, axis and primary branches simple; pedicels 0–3 mm long; bracts narrowly triangular, acute, 0.5–3 mm long, those subtending primary branches 1–3 mm long, those subtending flowers 0.5–1 mm long; *flowers* with hypanthium obconic, 0.8–1.2 mm long; calyx limb green, glabrous, 1–3.5 mm long, divided partially to completely, lobes 5, triangular to ligulate, acute; corolla funnelform, white tinged with lilac or purple, glabrous, tube 6–8 mm long, ca. 1 mm wide at base, ca. 2 mm wide at apex, lobes 5, triangular, 2–3 mm long, 0.5–1 mm wide, acute; stamens 5, attached in upper part of corolla, anthers 1–1.5 mm long, included or partially exserted; style surrounded at base by annular disk ca. 0.5 mm high, glabrous, ca. 8 mm long, with stigma ca. 0.5 mm long. *Infructescences* similar to inflorescences, becoming purple; fruit ellipsoid, 4.5–5 mm long, ca. 4.5 mm wide, becoming black; pyrenes 2, ca. 4 mm long, planoconvex with ca. 5 rounded ridges on back.

Distribution and ecology. Southern Mexico to Guatemala and adjacent El Salvador, in wet highland forest and cloud forest at 2,000–3,300 m, frequently on windswept ridges.

Phenology. Collected in flower April–May, in fruit August–November.

These plants are low shrubs or subshrubs that are infrequently collected. Very few mature flowers and fruits have been seen; whether this species is distylous cannot be determined from the material available. The type specimens of these epithets clearly represent the same taxon. The type collection of *Psychotria minarum* has mature infructescences and fruits, while that of *P. lilacina* has only immature flowers on an unexpanded inflorescence. The name *P. minarum* was accompanied by a more complete description and exemplary type specimen, and is selected here.

Additional specimens examined. El Salvador. santa ana: Cerro Montecristo, *W. B. Heed*, 4–6 Feb. 1954 (F); Montecristo, 2,300 m, 23 May 1963, *A. Molina R. & A. R. de Molina 12673* (F). Guatemala. chiquimula: middle slopes of Montaña Norte to El Jutal, on Cerro Brujo, SE of Concepción de las Minas, 1,700–2,000 m, 2 Nov. 1939, *J. A. Steyermark 31007* (F). el progreso: hills N of Finca Piramonte, between Finca Piramonte and summit of Volcán Santa Luisa, 2,400–3,333 m, 5 Feb. 1942, *J. A. Steyermark 43492* (F). huehuetenango: Cerro Cananá, between Nucapuxla and Cananá, Sierra de los Cuchumatanes, 2,500–2,800 m, 18 July 1942, *J. A. Steyermark 49107* (F). zacapa: summit of Sierra de las Minas, vicinity of Finca Planados, 2,500 m, 14 Oct. 1939, *J. A. Steyermark 29961* (F). Mexico. chiapas: municipio Tenejapa, barrio Banabil, paraje of Matsab, 8,800 ft., 26 Aug. 1966, *D. E. Breedlove 15332* (F). oaxaca: municipio San Miguel Chimalapa, cima del cerro Salomon, al NO de Benito Juárez, ca. 44 km al N de San Pedro Tapanatepec, 16°46′15″N, 94°11′45″W, 1,770 m, 11 Apr. 1986, *M. Ishiki 1510* (MO).

Psychotria phanaerandra (Standley & Steyerm.) Lorence, comb. nov. Basionym: *Palicourea phanaerandra* Standley & Steyerm., Publ. Field Mus. Nat. Hist., Bot. Ser. 23: 252. 1947. TYPE: Guatemala. Izabal: Cerro San Gil, 1,200 m, 26–27 Dec. 1941, *J. A. Steyermark 41952* (holotype, F; isotype, US). Lorence & Dwyer (1987: fig. 3a, b).

Psychotria luteotuba Lorence, Bol. Soc. Bot. México 47: 55. 1987. Syn. nov. TYPE: Mexico. Veracruz: municipio Hidalgotitlán, zona de Uxpanapa, Río Solusuchil a 5–6 km ESE de Hermanos Cedillo, 100–200 m, 24 Mar. 1982, *D. Lorence et al. 3910* (holotype, MEXU; isotypes, BM, BR, CHAPA, ENCB, F, MO, UC, XAL).

Glabrous or minutely hirtellous shrubs or small trees to 4 m tall, stems becoming terete. *Leaf* blades elliptic to ovate-elliptic, 4–10(–12.5) × (1.8–)2.4–

4.7 cm, acuminate at apex with tip to 2 cm long, acute to cuneate or attenuate or (rarely) obtuse at base, chartaceous; secondary veins 5–10 pairs, arching, without domatia, with 1(–2) intersecondary veins perpendicular to costa, midrib and secondary veins prominulous on both surfaces; margins slightly revolute; petioles 1.5–10 mm long; stipules persistent, with truncate circumferential sheath 0.4–0.8 mm long, with 2 lobes on each side, these narrowly triangular to acicular, 0.3–0.6 mm long, acute, deciduous. *Inflorescences* terminal, panicle rounded, 15–22-flowered, 25–60 mm long including corollas, 15–35 mm wide, green, erect; peduncle 15–35 mm long; primary branches 2–4 pairs, axis and primary branches simple or branched once; pedicels 0–1.5 mm long; bracts triangular to narrowly so, 0.5–3 mm long, those subtending primary branches 1–3 mm long, those subtending flowers 0.5–1 mm long; *flowers* distylous, with hypanthium obconic, ca. 0.5 mm long; calyx limb green, glabrous, 0.5–0.8 mm long, divided partially to completely, lobes 5, triangular, 0.4–0.6 mm long, ca. 0.2–0.5 mm wide, subequal, acute to obtuse; corollas funnelform, yellow, glabrous or minutely hirtellous externally, internally glabrous except for a ring 1–2 mm wide of sparse pilosulous pubescence just below filament attachment, tube 8–13 mm long, ca. 1 mm wide at base, ca. 2–2.5 mm wide at throat, lobes (4–)5, triangular to somewhat ovate or ligulate, 3–4 mm long, acute to rounded; stamens (4–)5, in long-styled form attached in upper third of corolla tube with filaments 0.5–1 mm long and anthers 2–3 mm long and included, in short-styled form attached at apex of tube with filaments 1–3 mm long and anthers 2–3 mm long and exserted; style surrounded at base by annular disk 0.5–0.8 mm high, glabrous, in long-styled form extending 2–3 mm beyond apex of corolla tube with stigmas ca. 0.5 mm long, in short-styled form 6.5–8 mm long with stigmas ca. 1 mm long. *Infructescences* similar to inflorescences, becoming purple; fruit ovoid, laterally compressed, somewhat didymous, 5–7 mm long, 5–6.5 mm wide, becoming black; pyrenes 2, 4–5 mm long, plano-convex with 3–5 rounded ridges on back.

Distribution and ecology. Southern Mexico to Panama, though markedly less frequently collected in the southern part of its range, in wet lowland evergreen forests and montane wet or cloud forests at 20–2,100 m.

Phenology. Collected in flower March–June and in December, in fruit July–December and in February.

The general appearance and biology of this species are described by Lorence & Dwyer (1987). The type collection of *Palicourea phanaerandra* has only immature flowers, but clearly represents the same species. The identity of this name was unknown for a long time; Standley & Williams did not include it in the *Flora of Guatemala* (1975).

Selected specimens examined. COSTA RICA. CARTAGO: Valle Escondido, 750 m, 1 Apr. 1966, *C. Schnell 807* (F). HEREDIA: Parque Nacional Braulio Carrillo, 600 m, 24 Mar. 1982, *I. A. Chacón 55* (CR); Estación Carrillo de la fila al cañon del Río Sucio, 450–700 m, 12 Nov. 1983, *I. A. Chacón & G. Herrera 1670* (CR). LIMON: Cantón de Limón, El Progreso 0.5 km al E de Cerro Muchilla, fila Matama, Valle de La Estrella, 9°47′50″N, 83°05′30″W, 850 m, 9 Apr. 1989, *G. Herrera 2573* (CR, MO), 5 Apr. 1989, *R. Robles & A. Chacón 2658* (CR, MO). HONDURAS. COMAYAGUA: ca. 10 km W of Siguatepeque, 1,800 m, 18 May 1972, *D. Burch 6106* (MO). CORTES: along Lake Yojoa ca. 5 km N of Rancho Agua Azul, 630 m, 11 Apr. 1951, *L. O. Williams & A. Molina R. 17762* (F). MEXICO. CHIAPAS: municipio Rayón, near Puerto del Viento, 9 mi. N of Pueblo Nuevo Solistahuacan, along road to Tapiula, 6,100 ft., 30 May 1965, *D. E. Breedlove 10173* (MO). GUERRERO: Montes de Oca, Pilas-Pasión, 2,100 m, 10-4-1937, *G. Hinton 10757* (F). OAXACA: por la vereda a arroyo Plata, 16°52′N, 94°37′W, 400 m, 3 Sep. 1985, *H. Hernández G. 1439* (CHAPA, PTBG). TABASCO: municipio Huimanguillo, km 10, Ejido T. Nueva, 20 m, 4 Apr. 1972, *Puig 777* (MEXU). VERACRUZ: municipio Catemaco, entre de Bastonal y Arroyo Claro, 14 km al E de Lago Catemaco, 900 m, 10 June 1972, *J. H. Beaman 6124* (F, MEXU, MO). PANAMA. COCLE: on ridge W of sawmill above El Copé, 903–1,161 m, 21 June 1978, *B. Hammel 3558* (MO).

Psychotria galeottiana (M. Martens) C. M. Taylor & Lorence, Taxon 34: 669. 1985. *Palicourea galeottiana* M. Martens, Bull. Acad. Roy. Soc. Sci. Bruxelles 11: 136. 1844. *Uragoga galeottiana* (M. Martens) Kuntze, Revis. Gen. Pl. 2: 960. 1891. TYPE: Mexico. Oaxaca: without location, *Galeotti 2606* (lectotype, designated by Taylor & Lorence, 1985, BR; isolectotypes, K, P). Figure 1.

Palicourea seleri Loes., Verh. Bot. Vereins Brandenburg 65: 114. 1923. Syn. nov. SYNTYPES: Guatemala. Huehuetenango: zwischen Trinidad und Rosario, 13 Aug. 1896, *C. Seler & E. Seler 3049* (syntype, B destroyed, photos, F, GH, MO, NY, US, fragment, F; isosyntype, GH); Yalambohoch, *C. Seler & E. Seler 2676* (syntype, B destroyed).

Psychotria skutchii Standley, Publ. Field Mus. Nat. Hist., Bot. Ser. 17: 283. 1937. Syn. nov. TYPE: Guatemala. Huehuetenango: San Juan Ixcoy, 8,000 ft. [2,581 m], 22 Aug. 1934, *A. Skutch 1074* (holotype, F; isotype, A).

Psychotria pachecoana Standley & Steyerm., Publ. Field Mus. Nat. Hist., Bot. Ser. 22: 205. 1940. Syn. nov. TYPE: Guatemala. Baja Verapaz: N of divide N of Santa Rosa, 1,650 m, 30 Mar. 1939, *P. C. Standley 69922* (holotype, F).

Psychotria persearum Standley, Ceiba 1: 48. 1950. Syn.

nov. TYPE: Honduras. Francisco Morazán: Cerro de Uyuca, 1,800 m, 2 Mar. 1947, *P. C. Standley 4865* (holotype, F; isotype, EAP).

Psychotria uyucana Standley, Ceiba 1: 48. 1950. Syn. nov. TYPE: Honduras. Francisco Morazán: drainage of Río Yeguare, Mt. Uyuca, 14°N, 87°W, 2,000 m, 29 May 1948, *A. Molina R. 919* (holotype, F; isotype, EAP).

Psychotria orogenes L. O. Williams, Phytologia 28: 231. 1974. Syn. nov. TYPE: Guatemala. Baja Verapaz: Sierra de las Minas, ca. 5 km S of Purulhá, 1,600 m, 2 Jan. 1973, *L. O. Williams et al. 41924* (holotype, F).

Palicourea macrantha auct., non Loes. (Taylor, 1989).

Glabrous or puberulent to densely pilosulous shrubs or small trees to 5 m tall with trichomes to 0.3 mm long and sometimes yellow or yellow-brown, stems becoming terete. *Leaf* blades elliptic to narrowly so, 4–15 × 1.2–4 cm, acute to acuminate at apex with tip 1–2 cm long, acute or cuneate to rounded at base, chartaceous, frequently pale abaxially, without domatia; secondary veins 7–18 pairs, arching, with 1–3 intersecondary veins perpendicular to costa, midrib and secondary veins smooth adaxially, prominulous below; margins flat; petioles 2–17 mm long; stipules persistent, with truncate circumferential sheath 1–2(–4) mm long, with 2 lobes on each side, these narrowly triangular, 0.5–4 mm long, acute. *Inflorescences* terminal, panicles pyramidal to rounded, 10–30-flowered, 1.5–9.5 cm long including corollas, 2–11 cm wide, green, erect to deflexed; peduncles 1–4 cm long; primary branches 1–3 pairs, axis and primary branches simple or branched once or twice; pedicels 0–5 mm long; bracts narrowly triangular to linear, 0.5–14 mm long, those subtending primary branches 1–14 mm long, those subtending pedicels 0.5–3 mm long; *flowers* distylous, with hypanthium obconic, ca. 0.8–1 mm long; calyx limb green, puberulent to densely pilosulous with trichomes to 0.3 mm long, 0.3–1.5 mm long, divided nearly completely, lobes 5, triangular, often strongly unequal, acute to obtuse; corolla funnelform, white sometimes flushed with pink or lavender, externally puberulent to pilosulous with trichomes to 0.2 mm long, internally glabrous except for a ring 2–4.5 mm wide of sparse pubescence near middle of tube, tube 5–10 mm long, ca. 1 mm wide at base, 3–4 mm wide at apex, lobes 5, triangular, 2–3 mm long, 1–2 mm wide, acute; stamens 5, in long-styled form attached in upper third of corolla tube with anthers subsessile, 1.8–2 mm long, and partially exserted, in short-styled form attached at apex of tube with filaments 1–2 mm long and anthers 2–2.5 mm long and partially to wholly exserted; style surrounded at base by annular disk ca. 0.5 mm high, glabrous, in long-styled form extending 1–2 mm beyond apex of the corolla tube with stigmas 0.3–1 mm long, in short-styled form 4–7 mm long with stigmas 1.5–2 mm long. *Infructescences* similar to inflorescences, becoming purple; fruit ellipsoid, somewhat compressed laterally, 3–4 mm long and wide, becoming black; pyrenes 2, 3–3.5 mm long, with ca. 5 rounded ridges on back.

Distribution and ecology. Southern Mexico to Nicaragua, common in Mexico, Guatemala, and Honduras but markedly less frequently collected in the southern portion of its range, in wet forest and cloud forest at 1,400–3,050 m.

Phenology. Collected in flower and fruit throughout the year, but more frequently collected in flower April–June and in fruit August–December.

As circumscribed here, this species varies widely in pubescence. Plants range from completely glabrous to densely pilosulous on all parts, with the pubescence usually golden and spreading. All intermediate pubescence conditions are represented by specimens, including types. The most densely pubescent forms are found from Chiapas to Honduras, but glabrous individuals occur in the same range. Both glabrous and densely pubescent individuals are represented from the same sites, and even in the same collection (*Croat & Hannon 64040*, MO). No other characteristics show correlation with the variation in pubescence, and pubescence is here rejected as a species-level characteristic. The epithets "*galeottiana*," "*persearum*," and "*uyucana*" were based on glabrous specimens, "*skutchii*" and "*seleri*" on moderately pubescent specimens with the inflorescences and leaves smaller than average, and "*orogenes*" and "*pachecoana*" on densely pubescent specimens with leaves larger than average.

The reproductive features, notably the inflorescence and corollas, are variable as well, but they likewise show no correlation with variation in other characters. The inflorescences of *Psychotria galeottiana* vary continuously from relatively open with about 15 flowers to relatively contracted with about 50 flowers, throughout the range of the species. The types of several of the epithets listed above, notably "*uyucana*," show these relatively more contracted inflorescences, but cannot be segregated on this basis. The corolla is usually pentamerous, but some individual flowers may occasionally be tetramerous in the same inflorescence (Fig. 1).

Selected specimens examined. GUATEMALA. ALTA VERAPAZ: 2–3 mi. S of Purulhá on Hwy. 14 to Cobán, 1,500–1,600 m, 21 July 1977, *T. B. Croat 41746* (MO). BAJA VERAPAZ: Chilasco, 4 Aug. 1971, *E. Contreras 10967* (F, MO). CHIMALTENANGO: Santa Elena, 9,000–10,000

Figure 1. *Psychotria galeottiana* (M. Martens) C. M. Taylor & Lorence. —A. Habit. —B. Detail of inflorescence, showing tetra- and pentamerous corollas of short-styled flowers. Photos taken in the Sierra de Juárez of Oaxaca, Mexico (*Lorence 4196*).

ft., 18 July 1933, *A. Skutch 443* (F, US). EL QUICHE: ca. 2 km E of Nebaj, *E. Contreras 4921* (MO). SAN MARCOS: between Todos Santos and Finca El Porvenir, lower to middle slopes of Volcán Tajumulco, 1,300–3,000 m, 1 Mar. 1940, *J. A. Steyermark 37021* (F). ZACAPA: ravine bordering Quebrada Alejandrina, summit of Sierra de las Minas, vicinity of Finca Alejandrina, 2,500 m, 13 Oct. 1939, *J. A. Steyermark 29821* (F). HONDURAS. EL PARAISO: Cerro Monserrat, cerca de Yuscarón, 2,000 m, 6–9 Oct. 1977, *C. Nelson & E. Romero 4326* (MO). FRANCISCO MORAZAN: Cerro de Uyuca, 6,300 ft., 10 June 1948, *S. F. Glassman 1532* (EAP, F, NY), 16 June 1948, *S. F. Glassman 1628* (EAP, F, NY), 17 July 1948, *S. F. Glassman 1945* (EAP, F, NY), *J. W. Miller*, 1950 (EAP). OCOTEPEQUE: Mt. Merendón, 10 Sep. 1973, *D. Hazlett 806* (MO). MEXICO. CHIAPAS: municipio Jitotol, ca. 12 km N of Jitotol along a side road to an oil well, 2,000 m, 28 Sep. 1971, *D. E. Breedlove 19954* (MO), 28 Oct. 1971, *D. E. Breedlove & R. E. Thorne 21495* (F, MO, NY). GUERRERO: distrito Montes de Oca, Pilas-Pasión, 2,100 m, 10 Apr. 1937, *G. Hinton et al. 10757* (MO). HIDALGO: municipio Tenango de Doria, arroyo a 5 km por camino al E de Tenango de Doria a El Cirio, 1,700 m, 9 Nov. 1985, *D. H. Lorence & R. Hernández*

Figure 2. *Psychotria juarezana* C. M. Taylor & Lorence. —A. Habit. —B. Detail of inflorescence showing tetramerous and pentamerous corollas of long-styled flowers. Photos taken in the Sierra de Juárez of Oaxaca, Mexico (*Lorence 4266*).

M. 4921 (MEXU, MO). OAXACA: distrito Ixtlán de Juárez, Sierra de Juárez, ruta 175 Tuxtepec a Oaxaca, 14 km por camino al NE de Cerro Humo Chico y Cerro Pelón, 2,200 m, 28 May 1990, *D. H. Lorence & R. Cedillo T. 4175* (MO). PUEBLA: Cascada Oligui entre Teziutlan y Tlapacoyán, 1,550 m, 2 June 1968, *D. Garcia S. 73* (MO). VERACRUZ: municipio Banderilla, Rancho La Martinica, 5 km al N del pueblo de Banderilla, 19°35′N, 96°57′W, 1,500 m, 6 May 1978, *J. I. Calzada 4387* (F). NICARAGUA. JINOTEGA: Cerro Kilambe, falda E del Pico Piedras Pelona, 13°34′N, 85°50′W, 1,300–1,400 m, 28 Mar. 1981, *P. P. Moreno 7775* (MO). MATAGALPA: W slope and summit of Cerro El Picacho, ca. 13°00′N, 85°55′W, 1,350–1,590 m, 3 June 1983, *W. D. Stevens & P. P. Moreno 22179* (MO). NUEVA SEGOVIA: faldas al S de Cerro Mogotón, 1,600 m, 12 June 1975, *J. Atwood & D. Neill 21* (MO). ZELAYA: Cerro Saslaya, 20 km W of Siuna, 1,100–1,400 m, 5 May 1977, *D. Neill 1845* (MO), 1,400–1,600 m, 4 May 1978, *D. Neill 3855* (MO).

Description of a New Species

Psychotria juarezana C. M. Taylor & Lorence, sp. nov. TYPE: Mexico. Oaxaca: distrito Ixtlán

de Juárez, Sierra de Juárez, ruta 175, Tuxtepec a Oaxaca ca. 4 km al SO de La Esperanza, 1,700 m, 4 Apr. 1983, *D. H. Lorence 4266* (holotype, MO #3750634; isotype, MEXU). Figure 2.

Species *Psychotriae galeottianae* (M. Martens) C. M. Taylor & Lorence affinis, sed inflorescentia minus deflexa, limbo calycino 1–2.5 mm longo, bracteis majoribus 2–10 mm longis differt.

Glabrous shrubs or small trees to 2 m tall, stems terete. *Leaf* blades elliptic to slightly oblanceolate, 4–11.5 cm long, 1.4–3.8 cm wide, acuminate at apex with tip 1–1.5 mm long, acute at base, chartaceous, pale abaxially; secondary veins 5–10 pairs, arching, without domatia, with 1(–2) intersecondary veins perpendicular to costa, midrib and secondary veins prominulous on both surfaces; margins flat; petioles 2–22 mm long; stipules persistent, with truncate circumferential sheath 1–1.5 mm long, with two lobes on each side, these narrowly triangular, 1.8–4 mm long, acute. *Inflorescences* terminal, panicles pyramidal, 5–15-flowered, 8–25 mm long including corollas, 8–20 mm wide, green, nodding; peduncle 15–27 mm long; primary branches 1–2 pairs, axis and primary branches simple or rarely branched once, each terminating in a cymule of 2–5 flowers; pedicels 0–22 mm long; bracts triangular, acute, 2–10 mm long, those subtending primary branches 7–10 mm long and those subtending flowers 2–7 mm long; *flowers* distylous; hypanthium obconic, ca. 0.8–1 mm long; calyx limb green, glabrous, 1–2.5 mm long, divided partially to completely to base, lobes 5, ligulate, 0.5–1 mm wide, frequently strongly unequal, acute; corolla funnelform, white or sometimes flushed with purple near base, glabrous except for a ring 2–3 mm wide of pilosulous pubescence internally at middle of tube, tube 7–10 mm long, ca. 1 mm wide at base, ca. 4 mm wide at apex, lobes 5, triangular, 3–3.5 mm long, acute; stamens 5, in long-styled form attached in upper third of corolla tube with anthers sessile, 1.8–2 mm long, and partially exserted, in short-styled form attached at apex of tube with filaments ca. 2 mm long and anthers ca. 2 mm long and partially to wholly exserted; style surrounded at base by annular disk ca. 0.8 mm high, glabrous, in long-styled form extending ca. 3 mm beyond apex of corolla tube with stigmas ca. 0.3 mm long, in short-styled form ca. 4–5 mm long with stigmas ca. 1 mm long. *Infructescences* similar to inflorescences, becoming purple; fruit ellipsoid, ca. 5 mm long, ca. 4.5 mm wide, becoming black; pyrenes 2, ca. 4 mm long, planoconvex with ca. 5 ridges on back.

Distribution and ecology. Southern Mexico, in wet montane cloud forests with *Pinus*, *Engelhardtia*, *Magnolia*, *Ardisia*, *Podocarpus*, *Quercus*, and *Weinmannia* at 1,550–3,000 m elevation.

Phenology. Collected in flower in April, June, and August, in fruit September–October.

This new species is similar to *Psychotria galeottiana* and is probably closely related to it. The latter species can be separated by its erect or slightly deflexed pyramidal inflorescences 1.5–9.5 cm long with pedicels 0–5 mm long and linear floral bracts 0.5–3 mm long, calyx lobes 1.5 mm long or shorter though often strongly unequal, and less strongly exserted style and stamens. The specific epithet refers to the type locality.

Paratypes. MEXICO. CHIAPAS: municipio Jitotol, ca. 12 km N of Jitotol along a side road to an oil well, 2,000 m, 28 Sep. 1971, *D. E. Breedlove 19954* (MO), 28 Oct. 1971, *D. E. Breedlove & R. F. Thorne 21495* (MO). OAXACA: distrito Ixtlán de Juárez, La Esperanza, Km 75 de la carretera Valle Nacional a Ixtlán, 3 Aug. 1981, *R. Cedillo T. et al. 923* (MEXU, MO); 4 km al SW de la Esperanza, 1,800 m, 4 June 1983, *R. Cedillo T. & R. Torres C. 2412* (MEXU, MO); municipio de Comaltepec, carretera Valle Nacional–Oaxaca, al NE de Cerro Pelón, 3,000 m, Mar. 1983, *L. Cortés 138* (MEXU, MO); Sierra de Juárez, along Hwy. 175 between Valle Nacional and Oaxaca, 26 mi. above (W of) Valle Nacional, 1,900 m, 30 June 1977, *T. B. Croat 39846* (MO), *39850* (MO); distrito Ixtlán de Juárez, Sierra de Juárez, ruta 175 Tuxtepec a Oaxaca, 3 km al SO de la Esperanza, 1,550 m, 17 Apr. 1982, *D. H. Lorence et al. 4051* (MEXU, MO); distrito Ixtlán de Juárez, Sierra de Juárez, Ruta 175 Tuxtepec a Oaxaca, ca. 4 km al SW de La Esperanza, 1,700 m, 4 Apr. 1983, *D. H. Lorence 4267* (MEXU, MO).

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Hiemobotrychium, a New Section of *Botrychium* Subgenus *Sceptridium* from the Southeastern United States

W. H. Wagner, Jr.
Department of Biology and Herbarium, University of Michigan,
Ann Arbor, Michigan 48109, U.S.A.

ABSTRACT. Ecological, morphological, and anatomical characters support the recognition of a section, designated here as *Botrychium* sect. *Hiemobotrychium*, distinct in the characters described from section *Sceptridium*. It is monotypic and based on *B. lunarioides* (Michaux) Sw.

The evergreen grapeferns, *Botrychium* subg. *Sceptridium*, are represented in the New World by 14 species, half of them found north of Mexico. The most peculiar member of the subgenus is the winter or prostrate grapefern, *B. lunarioides*, a very rare and local species of the southeastern United States (Wagner, 1961). Distinct in many respects from its relatives, it is placed in a monotypic section.

Botrychium sect. **Hiemobotrychium** W. H. Wagner, sect. nov. TYPE: *Botrypus lunarioides* Michaux, *Botrychium lunarioides* (Michaux) Sw.

Folium in serum autumnum et hiemem usque ad maturitatem crescens. Radices 20–30 per plantam, luteobrunneae. Stipes communis cellulis giganteis internis similibus tracheidarum instructus. Trophophora brevistipitata prostrataque, plerumque 2, deltata, 2–3-pinnata, herbacea. Venatio pinnularum flabellata, dichotoma, sine costa. Primordia foliorum pilis sparsis munita. Axes sporophorum late complanati, succulenti, usque ad 1.4 mm lati.

Leaf growing and maturing during late fall and winter. Roots 20–30, yellow-brown. Common stalk with tracheoidal idioblasts. Trophophores short-stalked and prostrate, usually 2 per plant, deltate, 2–3-pinnate, herbaceous. Pinnule venation flabellate, dichotomous, lacking midrib. Leaf primordia with scattered hairs. Sporophore axes broadly flattened, fleshy, to 1.4 mm wide.

Botrychium lunarioides differs from typical members of section *Sceptridium* in the following characteristics: its curious seasonality, the plant wholly underground and dormant for 8 to 9 months of the year, including most of spring, summer, and fall, rather than being essentially evergreen and visible at all seasons as in section *Sceptridium;* in the numerous, yellow-brown narrow roots rather than few, blackish thick roots; the presence of curious giant tracheidlike cells in the major axes (Arnott, 1960, figs. 1–4) that are lacking in *Sceptridium;* the prostrate, short-stalked trophophores, usually 2 per plant rather than upright, long-stalked trophophores, 1 per plant; the flabellate-dichotomous pinnule venation rather than pinnate pinnule venation; the primordia with few, scattered hairs rather than with numerous, densely matted hairs; and the flattened, very fleshy axes of the sporophore rather than nearly terete, only moderately fleshy axes.

Recent field investigations by Thomas (1978, 1979) have not only produced more localities, but extended the known range considerably. The species is now known from the Coastal Plain and outer Piedmont from the Carolinas to Arkansas and eastern Texas. It is rarely collected because of its unusual seasonality, growing at a time when few botanists are in the field; its flattened fronds being commonly partially covered by adjacent vegetation; and its occurrence in unexpected places, such as weedy roadsides and cemeteries.

Were it not for the somewhat intermediate species, *Botrychium jenmanii* L. Underw., section *Hiemobotrychium* would be a candidate for recognition as a separate subgenus of *Botrychium*. Technically speaking, *B. jenmanii* (Alabama grapefern), an often associated species, conforms with the major features of section *Sceptridium*, even though in a number of respects its characters suggest an affinity to *B. lunarioides*. The hypothesis has been proposed that *B. jenmanii* is the ancient hybrid of *B. biternatum* (Savigny) Underw. and *B. lunarioides* (Wagner, 1968: 118, 120, fig. 2). *Botrychium jenmanii* commonly occurs side-by-side with *B. biternatum* and/or with *B. lunarioides*. In northward extent, in eastern North America, *B. biternatum* reaches as far as Maryland and eastern Pennsylvania, *B. jenmanii* as far as southwestern Virginia, but *B. lunarioides* reaches only as far as South Carolina. Both of the putative parents are diploids with $n = 45$; *B. jenmanii*, on the other hand, with $n = 90$, is the only New World polyploid in subgenus *Sceptridium*.

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Realignments in American *Croton* (Euphorbiaceae)

Grady L. Webster
Department of Botany, University of California, Davis, California 95616, U.S.A.

ABSTRACT. Revisional studies in *Croton* to achieve a more nearly phylogenetic classification necessitate a number of nomenclatural changes. The genera *Crotonopsis* and *Eremocarpus* are reduced to sections of *Croton*, and the new names *Croton michauxii* and *C. willdenowii* are proposed for the two species of *Croton* sect. *Crotonopsis*. For *Croton* sect. *Julocroton*, the 25 species accepted are enumerated, including 19 new names or new combinations.

In the course of an unpublished review of the sections of *Croton* L., I have found it necessary to make a number of changes in classification. Consequently, in order to be able to cite representative species for the 38 sections of *Croton*, a number of nomenclatural changes must be validated.

The generic circumscription of *Croton* that has been almost universally accepted by systematists for more than a century is that proposed by Jean Mueller (1865, 1866, 1873). In contrast to the earlier classification of Baillon (1858), Mueller recognized only four genera in the *Croton* alliance (subtribe Crotoneae Muell. Arg.): *Croton* L., *Julocroton* Mart., *Crotonopsis* Michaux, and *Eremocarpus* Bentham. These four taxa have in common (with rare exceptions in individual species) the diagnostic characters of stellate or lepidote indumentum, thyrsoid inflorescence with pistillate flowers at base, stamens inflexed in the bud, and carunculate seeds.

Although Bentham (1880) noted that *Julocroton* was excessively close to *Croton*, he accepted it hesitatingly. A more definite rejection of the Muellerian circumscription was made by Macbride (1951), who refused to recognize *Julocroton* as a distinct genus and incorporated the Peruvian species into *Croton*. Mueller (1866) had distinguished *Julocroton* from *Croton* by a supposed difference in the relative position of the sepals to the subtending bract, although in subsequent taxonomic treatments (as by Macbride), the highly asymmetrical and laciniate pistillate calyx of *Julocroton* was used as the distinguishing character. In agreement with Bentham (1880), who was one of the first to question the generic distinctness of *Julocroton*, I find the topology of sepal position versus bract an unusable character; and I concur with Macbride that the irregular laciniate calyx does not adequately distinguish *Julocroton* from various South American species of *Croton*.

In a review of the Euphorbiaceae in the southeastern United States (Webster, 1967), I reduced *Julocroton* to a section of *Croton*, but rather diffidently accepted *Crotonopsis* as a distinct genus. However, in reviewing all of the sections of *Croton*, it has become apparent to me that *Crotonopsis* is excessively close to *Croton* sect. *Gynamblosis* (Torrey) A. Gray. In particular, the main generic character of *Crotonopsis*—unicarpellate gynoecium and indehiscent fruit—represents merely the end-point in a reduction series from the 3-carpellate gynoecium of most *Croton* species through the 2-carpellate gynoecium of *Croton monanthogynus* Michaux to the 1-carpellate gynoecium of *Crotonopsis*. Consequently, there appears to be a much stronger case for treating *Crotonopsis* as a section of *Croton* than as an independent genus.

Although I did not consider the problem of *Eremocarpus* earlier, its situation is comparable to that of *Crotonopsis*. When Hooker (1838) described *Croton setigerus* Hook., he expressed doubt as to its position in his citation of the name as *Croton ? setigerus*. Following the creation of the monotypic genus *Eremocarpus* to accommodate this species (Bentham, 1844), it has been almost universally accepted (except by Greene (1891), who is hardly renowned as a "lumper"). However, *Eremocarpus setigerus* (Hook.) Benth. has a habit reminiscent of various herbaceous species of North American *Croton*, such as *C. capitatus* Michaux of section *Pilinophyton* (Klotzsch) A. Gray and *C. lindheimerianus* Scheele of section *Gynamblosis* (Torrey) A. Gray. The obsolete pistillate perianth was used by Mueller (1866) as the main generic character for *Eremocarpus*, but the staminate flowers are typical for *Croton;* and the 1-carpellate gynoecium apparently represents a reduction parallel to that discussed above for *Crotonopsis*. Thus, although I earlier accepted both *Crotonopsis* and *Eremocarpus* as distinct from *Croton* (Webster, 1975), their claim to generic separation now appears no better founded than that for *Julocroton*.

For all three of these satellite genera of *Croton*, a serious argument against their acceptance at the

generic rank is that it would lead to a blatantly nonphylogenetic classification; or, to use cladistic parlance, it would make *Croton* a thrice-paraphyletic genus. The only way to salvage such genera as *Julocroton* would be to split *Croton* into a large number of segregate genera, as Klotzsch (1841) attempted. Such an alternative, I believe, would be highly unacceptable because of problems in defining and recognizing the segregates, and because it would obscure the phyletic coherence of this great genus of nearly 1,000 species. Consequently, the three segregates are here treated as sections of *Croton*, and the necessary nomenclatural adjustments are proposed.

Croton L., Sp. Pl. 1004. 1753. Lectotype: *Croton aromaticus* L. (designated by Webster, 1967).

SECTION *CROTONOPSIS*

Croton sect. **Crotonopsis** (Michaux) Webster, stat. nov. Basionym: *Crotonopsis* Michaux, Fl. Bor.-Amer. 2: 185. 1803. *Leptemon* Rafinesque, Med. Repos. II. 5: 353. 1808, nom. superfl. TYPE: *Crotonopsis linearis* Michaux.

Friesia Sprengel, Anleit. Halle Gewächs. 2(2): 885. 1818. TYPE: *Friesia argentea* Sprengel [= *Crotonopsis linearis* Michaux].

This section contains two species, sometimes combined but well discriminated by Pennell (1918), followed by Correll & Johnston (1970). Unfortunately, both species have to be renamed because all available epithets are preoccupied in *Croton*.

1. Croton michauxii Webster, nom. nov. Replaced name: *Crotonopsis linearis* Michaux, Fl. Bor.-Amer. 2: 185. 1803, non *Croton linearis* Jacq., 1760. *Crotonopsis argentea* Pursh, Fl. Amer. Sept. 1: 206. 1814, nom. superfl.; non *Croton argenteus* L., !753. TYPE: U.S.A. South Carolina: Long Bay, *Michaux s.n.* (lectotype, selected here, Michaux Herbarium, P; microfiche seen). The only specific location given by Michaux was Long Bay, which is in South Carolina according to Ewan (1974); it seems appropriate to select it as the lectotype.

Crotonopsis spinosa Nash, Bull. Torrey Bot. Club 22: 157. 1895, non *Croton spinosus* Forsk., 1775. TYPE: U.S.A. Florida: Marion Co., Dunnellon, *Swingle 1397a* (holotype, NY).

2. Croton willdenowii Webster, nom. nov. Replaced name: *Crotonopsis elliptica* Willd., Sp. Pl. 4: 380. 1805, non *Croton ellipticus* Geiseler, 1807. TYPE: U.S.A. South Carolina: *Muehlenberg s.n.* (lectotype, selected here, Willdenow Herbarium 17490, B).

Crotonopsis abnormis Baillon, Etude Euphorb. 381. 1858 non *Croton abnormis* Baillon, 1864. TYPE: without locality, *Leconte s.n.* (P not seen).

Although Merrill (1949) listed three species of Rafinesque as synonymous with *Crotonopsis elliptica* Willd., Rafinesque did not cite Willdenow, and all three Rafinesque species—in the absence of clear typification—could possibly be synonyms of *Crotonopsis linearis* Michaux. It seems preferable, therefore, to apply a new name to the species that can be securely based on a type specimen.

SECTION *EREMOCARPUS*

Croton sect. **Eremocarpus** (Bentham) Webster, stat. nov. *Eremocarpus* Bentham, Bot. Voy. Sulphur 53. 1844. *Piscaria* Piper, Contr. U.S. Natl. Herb. 11: 382. 1906, nom. superfl. TYPE: *Croton setigerus* Hooker.

1. Croton setigerus Hooker, Fl. Bor.-Amer. 2: 141. 1838. TYPE: U.S.A. Oregon: Menzies' Island, and banks of Columbia River, *Douglas s.n.* (not seen; presumably at K).

SECTION *JULOCROTON*

Croton sect. **Julocroton** (Mart.) Webster, J. Arnold Arbor. 48: 354. 1967. *Julocroton* Mart., Flora Beibl. 1837(2): 119. 1837, nom. cons. TYPE: *Julocroton phagedaenicus* Mart. [= *Croton triqueter* Lam.].

Cieca Adanson, Fam. Pl. 2: 355. 1763, nom. rej. TYPE: *Croton argenteus* L.

Heterochlamys Turcz., Bull. Soc. Imp. Naturalistes Moscou 16: 61. 1843. TYPE: *Heterochlamys quinquinervia* Turcz. [= *Croton argenteus* L.].

Centrandra Karsten, Linnaea 28: 440. 1857. TYPE: *Centrandra hondensis* Karsten [= *Croton hondensis* (Karsten) Webster].

Julocroton subg. *Eremadenia* Didr., Vidensk. Meddel. Dansk Naturhist. Foren. Kjøbenhavn 1857: 134. 1857. TYPE: *Julocroton triqueter* Didr.

Julocroton subg. *Oligonychia* Didr., Vidensk. Meddel. Dansk Naturhist. Foren. Kjøbenhavn 1857: 132. 1857. TYPE: *Croton argenteus* L. (lectotype, selected here).

In the only general revision of *Julocroton* so far, Croizat (1943, 1944) recognized about 25 species. Species discrimination in the genus is difficult, and much work remains to be done in order to evaluate Croizat's proposals and determine how many valid binomials there are. Here I am making new combinations only for those species being cited as rep-

resentatives of section *Julocroton* in an unpublished survey of the sections of *Croton*. This includes most of the species cited by Mueller (1873), as well as those names of Croizat that I have been able to evaluate. Pending a critical revision of section *Julocroton*, it is not possible to evaluate all of the binomials that have been proposed, but possible synonyms have been indicated where appropriate. In the following enumeration the correct names under *Croton* are given for those species of *Julocroton* that could be verified and judged distinct. Unless otherwise noted, microfiches and photographs cited are at DAV.

1. **Croton abutilopsis** Webster, nom. nov. Replaced name: *Julocroton abutiloides* Spencer Moore, Trans. Linn. Soc. Bot. II. 4: 465. 1895, non *Croton abutiloides* HBK, 1817. TYPE: Brazil. Matto Grosso do Sul: Corumbá, *Moore 968* (holotype, BM not seen; photograph, B).
2. **Croton ackermannianus** (Muell. Arg.) Webster, comb. nov. Basionym: *Julocroton ackermannianus* Muell. Arg., Fl. Bras. 11(2): 283. 1873. TYPE: Brazil. Minas Gerais: *Ackermann s.n.* [var. *β ovatus*] (holotype, G not seen).
3. **Croton acuminatissimus** (Pittier) Webster, comb. nov. Basionym: *Julocroton acuminatissimus* Pittier, J. Wash. Acad. Sci. 20: 11. 1930. TYPE: Venezuela. Yaracuy: between La Piedra and Yaritagua, *Pittier 11175* (holotype, US).
4. **Croton allemii** Webster, nom. nov. Replaced name: *Julocroton ramboi* Smith & Downs, Sellowia 11: 153. 1959, non *Croton ramboi* Allem, 1979. TYPE: Brazil. Santa Catarina: Itapiranga, 1951, *Rambo s.n.* (*PACA 49824*) (holotype, US).

   It is appropriate to rename this species for my colleague Antonio Allem, who has contributed important publications on the systematics of *Croton* in southern Brazil.

5. **Croton argenteus** L., Sp. Pl. 1004. 1753. TYPE: America (probably in Hortus Cliffortianus Herbarium, BM not seen; possible isotype, 1140.8 in LINN, microfiche).

Probable synonyms, mostly indicated by Croizat (1943), include: *Julocroton camporum* Chodat & Hassler, *J. elaeagnoides* Spencer Moore, and *J. integer* Chodat & Hassler. Although accepted by Croizat as a distinct species, *J. montevidensis* Klotzsch ex Muell. Arg. may prove to be synonymous with *C. argenteus;* hence no new name is provided for it here.

6. **Croton calonervosus** Webster, nom. nov. Replaced name: *Julocroton nervosus* Baillon, Adansonia I. 4: 369. 1864, non *Croton nervosus* Klotzsch, 1843. TYPE: Brazil. Minas Gerais: *St. Hilaire B*[2] 2369 (lectotype, selected here, P not seen; photograph, DAV).
7. **Croton conspurcatus** Schldl., Linnaea 7: 380. 1832. *Julocroton conspurcatus* (Schldl.) Klotzsch, Arch. Naturgesch. 7: 193. 1841. *Julocroton triqueter* var. *conspurcatus* (Schldl.) Muell. Arg., DC. Prodr. 15(2): 705. 1866. TYPE: Mexico. Veracruz (?): "in dumetis prope Tioselo," *Schiede 39* (holotype, HAL not seen).
8. **Croton cordeiroae** Webster, nom. nov. Replaced name: *Julocroton riedelianus* Muell. Arg., Fl. Bras. 11(2): 278. 1873, non *Croton riedelianus* Muell. Arg., Linnaea 34: 104. 1865. TYPE: Brazil. São Paulo: São Carlos, *Riedel s.n.* (holotype, G not seen; photograph, DAV).

   The specific epithet acknowledges the contributions of my colleague, Iris Cordeiro, to the systematics of Euphorbiaceae (including sect. *Julocroton*) in São Paulo and adjacent areas of Brazil.

9. **Croton didrichsenii** Webster, nom. nov. Replaced name: *Julocroton humilis* Didr., Vidensk. Meddel. Dansk Naturhist. Foren. Kjøbenhavn 1857: 132. 1857, non *Croton humilis* L., 1753. TYPE: Brazil. São Paulo: Mugi, *Lund s.n.* (holotype, C not seen; microfiche of isotype at G).
10. **Croton doratophylloides** (Croizat) Webster, comb. nov. Basionym: *Julocroton doratophylloides* Croizat, Revista Argent. Agron. 10: 139. 1943. TYPE: Argentina. Misiones: Salto Iguazú, *Rodriguez 438* (holotype, A).
11. **Croton flavispicatus** Rusby, Mem. New York Bot. Gard. 7: 283. 1927. *Julocroton peruvianus* Muell. Arg. var. *flavispicatus* (Rusby) Croizat, Revista Argent. Agron. 10: 136. 1943. TYPE: Bolivia. La Paz: Ixiamas, *Cardenas 2026* (holotype, NY not seen; photograph, DAV).

Julocroton peruvianus Muell. Arg., DC. Prodr. 15(2): 704. 1866, non *Croton peruvianus* Briq., 1900. TYPE: Peru. Loreto: Tarapoto, *Spruce 4290* (holotype, G, microfiche seen).

Julocroton paniculatus Pax & Hoffm., Meded. Rijks-Herb. Leiden 40: 22. 1921, non *Croton paniculatus* Lam., 1786. TYPE: Bolivia. Santa Cruz: Río Pirai, *Herzog 1486* (holotype, B, photograph).

12. Croton fuscescens Sprengel, Syst. Veg. 2: 874. 1826. *Julocroton fuscescens* (Sprengel) Baillon, Adansonia I. 4: 367. 1864. TYPE: Brazil. Possibly from Rio de Janeiro, *Sellow s.n.* (not seen; microfiche of possible isotype at G).

Probable synonym: *Julocroton paulensis* Usteri, as pointed out by Croizat (1943).

13. Croton geraesensis (Baillon) Webster, comb. nov. *Julocroton geraesensis* Baillon, Adansonia I. 4: 370. 1864. TYPE: Brazil. Minas Gerais: *St. Hilaire B*[1] 1295 (holotype, P not seen; photograph, DAV).

Possible synonym: *Julocroton valenzuellae* (Chodat & Hassler) Croizat.

14. Croton hondensis (Karsten) Webster, comb. nov. Basionym: *Centrandra hondensis* Karsten, Linnaea 28: 440. 1857. *Julocroton hondensis* (Karsten) Muell. Arg., DC. Prodr. 15(2): 704. 1866. TYPE: Colombia. Tolima: Honda, *Karsten s.n.* (not seen).

15. Croton lanceolaris Webster, nom. nov. Replaced name: *Julocroton lanceolatus* Klotzsch ex Muell. Arg., DC. Prodr. 15(2): 702. 1866, non *Croton lanceolatus* Cav., 1800. TYPE: Brazil. São Paulo: Alegres, *Riedel 2806* (holotype, B presumed destroyed; photograph, DAV).

16. Croton microcalyx (Muell. Arg.) Webster, comb. nov. Basionym: *Julocroton microcalyx* Muell. Arg., Linnaea 34: 142. 1865. TYPE: Brazil. São Paulo: Salto Ytú, *Riedel 2180* (holotype, G not seen; photograph of isotype, DAV).

17. Croton phyllanthus (Chodat & Hassler) Webster, comb. nov. Basionym: *Julocroton phyllanthus* Chodat & Hassler, Bull. Herb. Boiss. II. 5: 501. 1905. TYPE: Paraguay. La Cordillera (?): Río Carimbatay, *Hassler 4576* (photograph of holotype, G).

18. Croton rupestris (Chodat & Hassler) Webster, comb. nov. Basionym: *Julocroton rupestris* Chodat & Hassler, Bull. Herb. Boissier II. 5: 498. 1905. TYPE: Paraguay. Paraguarí: Cordillera de Altos, *Hassler 3090, 3554* (syntypes, both at G; not seen).

Julocroton velutinus (Chodat & Hassler) Croizat, based on a variety of *J. rupestris*, is doubtfully distinct.

19. Croton rutilus (Chodat & Hassler) Webster, comb. nov. Basionym: *Julocroton rutilus* Chodat & Hassler, Bull. Herb. Boissier II. 5: 501. 1905. TYPE: Paraguay. Canindeyu: Sierra de Maracayu [Mbaracayú], Ipe hu [Ype Jhu], *Hassler 5226* (holotype, G not seen; isotype, UC). Possible synonym: *J. pulcher* Croizat.

20. Croton salzmannii (Baillon) Webster, comb. nov. Basionym: *Julocroton salzmannii* Baillon, Adansonia I. 4: 369. 1864. *Julocroton pycnophyllus* Schldl. ex Muell. Arg., DC. Prodr. 15(2): 705. 1866. TYPE: Brazil. Bahia: *Salzmann s.n.* (holotype, P not seen; microfiche of possible isotype at B).

Julocroton pycnophyllus, as originally proposed by Schlechtendal (Linnaea 19: 245. 1847), was not validly published. Although Mueller validated it in the *Prodromus*, Baillon had already provided a description under the name *Julocroton salzmannii*.

21. Croton solanaceus (Muell. Arg.) Webster, comb. nov. Replaced name: *Julocroton humilis* var. *solanaceus* Muell. Arg., DC. Prodr. 15(2): 701. 1866. *Julocroton solanaceus* (Muell. Arg.) Muell. Arg., Fl. Bras. 11(2): 279. 1873. TYPE: Brazil. São Paulo: Rio Verde, *Riedel 261* (holotype, B destroyed; isotype, G not seen).

The original type collection of Sellow at B cited by Mueller (1866) having been destroyed, the Riedel specimen cited by Mueller (1873) can be chosen as neotype because it has a specific locality. There is a photograph of the Sellow specimen at B.

Probable synonym: *Julocroton typhaecephalus* Croizat.

22. Croton subpannosus Muell. Arg. ex Griseb., Pl. Lorentz. 48. Dec. 1874. TYPE: Argentina. Córdoba: Aschochinga, *Lorentz 291* (holotype, GOET not seen; isotype, G not seen; photograph of presumed isotype at B, DAV). *Julocroton subpannosus* Muell. Arg., J. Bot. 12: 203. July 1874. TYPE: Argentina. Córdoba: Aschochinga, *Lorentz 291* (lectotype, selected here, G not seen).

Owing to the curious history of publication of this species, the holotype of *Julocroton subpannosus* Muell. Arg. is the same specimen as the isotype of *Croton subpannosus* Muell. Arg. ex Griseb. Croizat (1941) discussed the priority of the names of Mueller over those of Grisebach.

Croton dentosus Griseb., Pl. Lorentz. 49. 1874. TYPE: Argentina. Córdoba: Córdoba, *Lorentz 292* (holotype, GOET not seen; photograph of isotype at B).
Julocroton serratus Muell. Arg., J. Bot. 12: 227. Aug.

1874. TYPE: Argentina. Córdoba: Córdoba, *Lorentz 292* (lectotype, selected here, G).

There is the same relation between the two names and their types as in the preceding paragraphs. Croizat (1943) appears to be correct in combining *C. dentosus* with *C. subpannosus*.

Julocroton brittonianum Morong, Ann. New York Acad. Sci. 7: 222. 1893. TYPE: Paraguay. Río Pilcomayo, *Morong 864* (holotype, NY not seen).

Croizat (1943) reduced Morong's species to the synonymy of *C. subpannosus*.

23. Croton stipularis (Muell. Arg.) Webster, comb. nov. *Julocroton montevidensis* α [var.] *stipularis* Muell. Arg., DC. Prodr. 15(2): 703. 1866. *Julocroton stipularis* (Muell. Arg.) Muell. Arg., Fl. Bras. 11(2): 277. 1873. TYPE: Brazil. Goyaz: *Pohl 1647* (holotype, B destroyed).

24. Croton triqueter Lam., Encycl. 2: 214. 1786. *Julocroton triqueter* (Lam.) Didr., Vidensk. Meddel. Dansk Naturhist. Foren. Kjøbenhavn 1857: 134. 1857. TYPE: Brazil. Rio de Janeiro: Rio de Janeiro, *Commerson s.n.* (holotype, Herb. Jussieu 16339, P).

Julocroton phagedaenicus Mart., Flora 20, Beibl. 2: 119. 1837. TYPE: Brazil. *Martius 164* (holotype, M not seen; microfiche of isotype at G).

25. Croton verbascoides Webster, nom. nov. Replaced name: *Julocroton verbascifolius* Muell. Arg., DC. Prodr. 15(2): 701. 1866, non *Croton verbascifolius* Willd., 1803. TYPE: Brasilia meridionalis, *Sellow s.n.* (lectotype, selected here, G not seen; microfiche, DAV). Typification was effected by the Royal Air Force in destroying the other syntype at B.

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Eight New Species of *Ouratea* (Ochnaceae) from Mesoamerica

Caroline Whitefoord
The Natural History Museum, Cromwell Road, London SW7 5BD, England

ABSTRACT. Revision of the Ochnaceae for *Flora Mesoamericana* brought to light eight new species of *Ouratea*. These species are described here: *O. osaensis* and *O. rinconensis* from the Rincón de Osa area of Costa Rica, and *O. jefensis*, *O. knappiae*, *O. darienensis*, *O. stenobasis*, *O. sulcatinervia*, and *O. tristis* from Panama.

The genus *Ouratea* consists of about 150 species from Central and South America, and the West Indies; they are woody, glabrous plants characterized by alternate, simple leaves, bright yellow bisexual flowers, and fruits composed of 1-seeded glossy, black drupelets borne on an enlarged, fleshy, purplish red receptacle or torus. Asian and African species formerly included in *Ouratea* have been transferred to *Gomphia* (Kanis, 1968). Riley (1924) reviewed the Mexican and Central American species of *Ouratea*, increasing the number of species in the region from 9 to 15. Dwyer (1944) believed there were 28 species of *Ouratea* from Mexico, Central America, and the West Indies, of which 17 occurred in Mexico and Central America. Dwyer (1944) listed six species of *Ouratea* occurring in Belize and Guatemala, whereas Standley & Williams (1961) thought there were only three, with an additional variety in one of these. Dwyer (1944) had believed seven species occurred in Panama, but when he reviewed the Panamanian Ochnaceae (Dwyer, 1967) he made great changes, accepting eight species, with only three names unchanged from his 1944 account. As these earlier revisions had shown such large changes in Central American *Ouratea*, a thorough generic revision was clearly needed for *Flora Mesoamericana*. Covering the area from southern Mexico (the states of Yucatán, Tabasco, and Chiapas) to the Panama–Colombia border, the present study revealed the following new taxa, and a total of 22 *Ouratea* species in Mesoamerica. Eight of these are new and are described here so that the names can be used in the *Flora Mesoamericana* treatment.

1. Ouratea darienensis Whitefoord, sp. nov. TYPE: Panama. Darién: above Cana on trail to top of ridge of Pirre Massif, forested slopes, 1,100–1,350 m, 3 May 1990, *McPherson 15033* (holotype, BM; isotype, MO). Figure 1.

Ab *O. nitida* (Sw.) Engl. foliis nervis secondariis manifestiore distinctis late et irregulariter dispositis, calyce minore laeviore, differt.

Trees 8–15 m high, with slender branchlets. Leaves (10.5–)15–21 × 4–7 cm, lanceolate to oblong or oblanceolate, the base cuneate or rounded, the apex acuminate; chartaceous to coriaceous, drying red- or greenish brown, slightly glossy and rugulose, the margin slightly revolute, crenate; venation impressed on both surfaces, with 8–13 pairs of major secondary veins arcuate-ascending, more clearly evident beneath; petiole 4–10 mm; stipules ca. 6 mm, caducous. Inflorescence 8–17 cm, axillary, paniculate, the rhachis conspicuously flattened, 1–4-branched, the lower branches 3.5–7 cm long; flowers solitary or paired, sometimes shortly pedunculate, well-spaced; pedicel 5–6(–7) mm, slender; sepals 5, 4–5 mm long, ovate-lanceolate, thinly coriaceous, the inner margins scarious, the sepals and pedicel smooth and shiny; petals 5, 6 mm long, broadly obovate, clawed; stamens 10, the anthers 4 mm; gynophore 0.5 mm; style 2.5–3 mm. Fruit not seen.

Paratype. PANAMA. DARIEN: Parque Nacional del Darién, slopes of Cerro Mali, headwaters of S branch of Río Pucuro, ca. 22 km E of Pucuro, 1,300–1,400 m, *Cuadros, Hammel, de Nevers & Herrera 3966* (BM, MO).

Ouratea nitida (Sw.) Engler also has leaves with the venation impressed on both sides, a paniculate inflorescence, and a calyx with five sepals. *Ouratea nitida* is, however, a smaller plant, rarely reaching 6 m, and grows at altitudes up to 400 m, whereas *O. darienensis* is a tree of about 8 m, found at the much higher altitudes of 1,300–1,400 m. *Ouratea nitida* occurs from southern Mexico to Nicaragua, Guyana, Cuba, and Jamaica, whereas *O. darienensis* is known only from the state of Darién, Panama.

2. Ouratea jefensis Whitefoord, sp. nov. TYPE: Panama. Panamá: forested slopes of Cerro Jefe, near large coffee fincas, 24 Jan. 1970, *Wilbur, Weaver, Foster & Correa 11318* (holotype, BM; isotypes, F, MO, US). Figure 2.

Ab *O. insulae* Riley foliis multo brevioribus, rhachide graciliore, floribus late dispositis pedicellis longioribus filiformibus, differt.

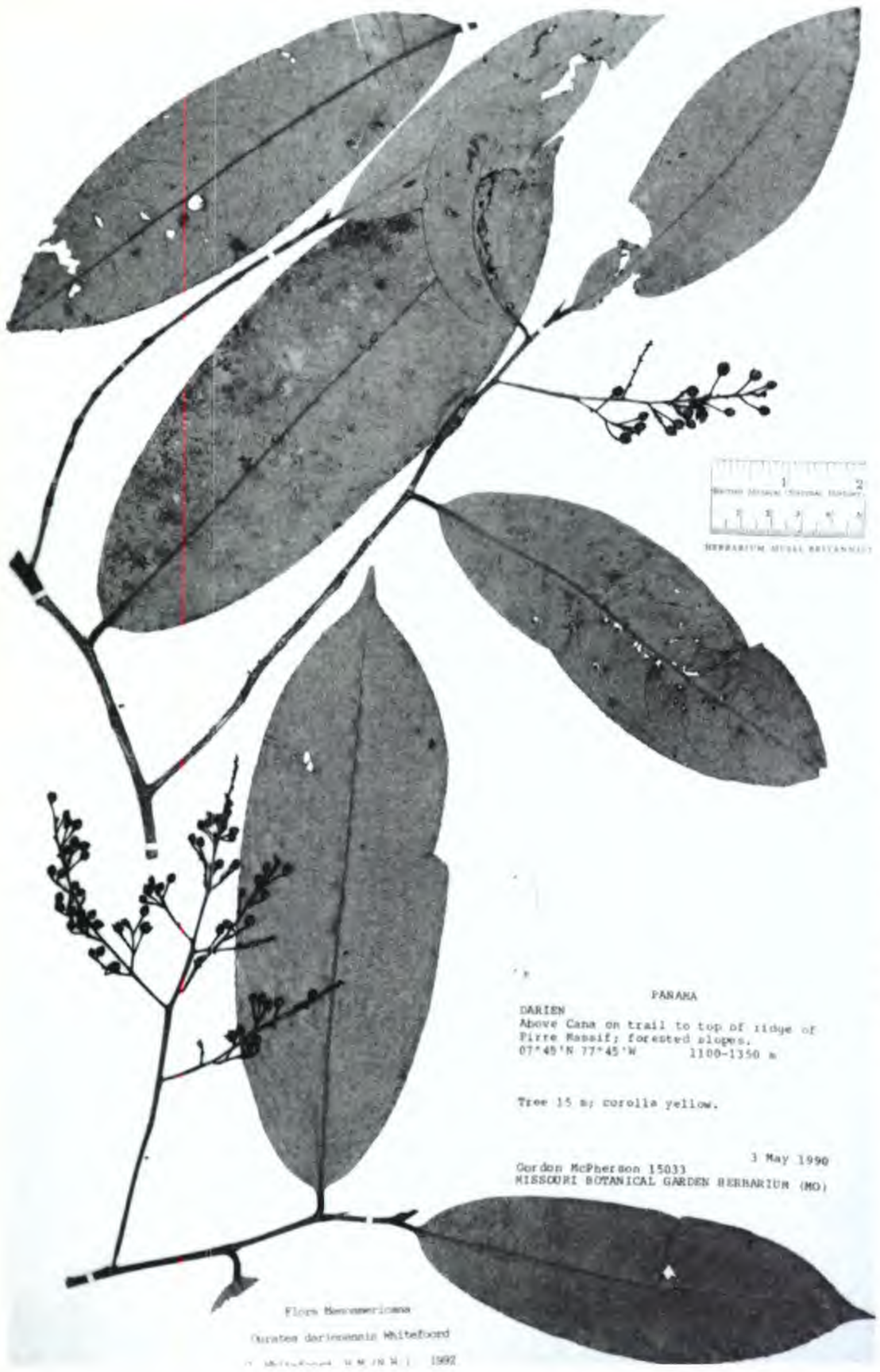

Figure 1. *Ouratea darienensis* (*McPherson 15033*, BM).

Figure 2. *Ouratea jefensis* (*Wilbur, Weaver, Foster & Correa 11318*, BM).

Shrubs or trees 3–8.5 m high, with slender branchlets. Leaves 8–11 × 2.5–4.5 cm, ovate-lanceolate or elliptic, the base cuneate or rounded, the apex acuminate; coriaceous, slightly glossy on both surfaces, drying greenish brown, the margin plane or slightly revolute, subentire or sometimes minutely toothed toward the apex, the teeth well-spaced; venation inconspicuous, the major secondary veins mostly 5–10 mm apart, arcuate-ascending, slightly raised above, the minor secondary and tertiary veins nearly straight, crowded, subparallel, immersed or scarcely raised on both surfaces; petiole 2–5 mm; stipules to 7 mm, caducous. Inflorescence to 10 cm, paniculate, terminal or axillary, usually broadly pyramidal; rhachis slender, smooth, with 1–3(–6) widely spaced, spreading, slender branches; flowers widely spaced, solitary or occasionally paired; pedicel (5–)10–12 mm, filiform; sepals 5, ca. 6 mm long, ovate-lanceolate, chartaceous, the inner margins scarious; petals 5, 8–9 mm long, broadly obovate, reflexed, falling before the sepals; stamens 10, the anthers 5 mm; gynophore 0.5–1.0 mm; style 4–5 mm, often flexuous. Torus 8–12 mm, obovoid; drupelets ca. 8 mm, subglobose to obovoid.

Paratypes. PANAMA. PANAMA: beyond Goofy Lake along road to Cerro Jefe, *Correa & Dressler 473* (MO); Cerro Jefe, 2,700 ft., *D'Arcy 12183* (MO); Cerro Jefe, *Duke 9405* (MO); Cerro Jefe to La Eneida, 21–2,900 ft., *Duke, Dressler & Dwyer 8191* (F, MO); 8 mi. S of Goofy Lake toward Cerro Jefe, *Dwyer 7082* (MO); Cerro Jefe, to 3,100 ft., *Dwyer 8482* (MO); summit of Cerro Jefe, 23 km N of Pan-American Hwy., 1,004 ft., *Folsom & Kearns 2718* (MEXU, MO); Cerro Jefe, summit to 1 mi. beyond, *Gentry, Dwyer & Tyson 3517* (MO); 800 m, *Gomez-Pompa, Quero & Gonzalez 3059* (MEXU, MO); 750 m, *Gomez-Pompa, Quero & Gonzalez 3550* (MEXU, MO); 12.5 km above Pan-American Hwy. on road from El Llano to Cartí–Tupile, 350 m, *Kennedy, Correa & Dressler 2489* (MO); NE of town of Cerro Azul, 20 km by road from Inter-American Hwy., *Mori & Kallunki 3644* (MO); NE of town of Cerro Azul, 20 km by road from Inter-American Hwy., *Mori & Kallunki 3656* (MO); slopes of Cerro Jefe between Cerro Azul and La Eneida, ca. 15 mi. NE of Panama City, *Wilbur, Almeda & Luteyn 15568* (MO); slopes of Cerro Jefe beyond Cerro Azul between 4 and 8 mi., *Wilbur & Weaver 11382* (MO).

Distribution. This species is known only from the Cerro Jefe area in premontane forest, from 350 to 954 m.

Ouratea jefensis, like *O. insulae* Riley from southern Mexico, Belize, Guatemala, and Honduras,

Figure 3. *Ouratea knappiae*, in flower (*Dressler 4332*, MO).

Figure 4. *Ouratea knappiae*, in fruit (*Knapp & Schmalzel 5477*, MO).

usually has a broadly pyramidal, paniculate inflorescence. *Ouratea insulae* differs in its much stouter rhachis and crowded flowers, the pedicels to 10 mm; *O. jefensis* has a slender rhachis, filiform pedicels (5–)10–12 mm, and well-spaced flowers. *Ouratea insulae* is a larger tree (to 25 m) with larger leaves (10–31 × 6–8 cm) than *O. jefensis*. Some specimens of *O. jefensis* have been determined as *O. cocleensis* Dwyer, now included in *O. prominens* Dwyer, a species with a 2-sepaled calyx from Nicaragua, Costa Rica, and Panama. Many herbarium specimens of *O. jefensis* have been labeled *O. lucens* (Kunth) Engl., a variable and widespread species. *Ouratea lucens* usually has a cylindrical inflorescence of crowded flowers on ascending pedicels (5–12 mm). Stipulelike scales, lacking in *O. jefensis*, tend to persist in clusters at the base of current growth in *O. lucens*. In *O. lucens* the leaves are larger (up to 29 cm long) and often obovate. This species is widely distributed, occurring from southern Mexico to Colombia, while *O. jefensis* is restricted to the Cerro Jefe region of Panama (after which it is named). *Ouratea lucens* is a very variable species, from which more taxa might eventually be split.

3. Ouratea knappiae Whitefoord, sp. nov. TYPE: Panama. Panamá: 8 km from Pan-American Hwy. on the El Llano–Cartí road, Río Teribe Valley, tropical wet forest, 300–400 m, 9 June 1982, *Knapp & Schmalzel 5477* (holotype, MO; isotypes, BM, MEXU). Figures 3, 4.

Ouratea valerii Standley valde affinis, sed foliis crassioribus subtilitis rugosis, toro minore, differt.

Trees 8–18(–25) m high, with stout branchlets, glabrous. Leaves (24–)30–40 × 6.5–10.5(–13) cm, narrowly oblong, narrowly elliptic or oblanceolate, the base rounded or sometimes cuneate, the apex acute, acuminate, or obtuse; stiffly and thickly coriaceous, minutely rugulose on both surfaces, drying reddish brown with a slight sheen, the margin revolute, subentire or sometimes crenulate-serrate toward the apex; venation inconspicuous with ca. 15–25 major and numerous minor secondary veins, widely arcuate-ascending, slightly impressed above and raised beneath, the tertiary veins crowded, spreading, immersed or impressed on both surfaces; petiole 5–10 mm, stout; stipules ca. 15 mm, sometimes persistent. Inflorescence 14–29 cm, terminal, broadly paniculate with ca. 4 stout branches, the

lowest branches to ca. 18 cm long; flowers often crowded, in stout-stalked clusters of 2–5; pedicel 10–14 mm, slender, incrassate upward; sepals 3(–5), when 3, 2 of the sepals with a deep longitudinal groove, 10–13 mm long, ovate-lanceolate, coriaceous, persistent, the inner margins scarious; petals 5, 11–18 mm long, obovate or oblong; stamens 10, the anthers to 12 mm; gynophore 1 mm; style 9–10 mm. Torus 5–10 mm, depressed-globose, the surface rough and wrinkled; drupelets to 15 mm, ellipsoid.

Paratypes. PANAMA. COLON: en la carretera a la zona maderera de Santa Rita, *Correa & Dressler 1206* (MO). PANAMA: El Llano–Cartí hwy., 6–10 km N of El Llano, *Dressler 4332* (MO); El Llano to Cartí road, 7.8 km N of Pan-American Hwy., *Folsom 3559* (MO); road from El Llano to Cartí, 7.4 km N of Pan-American Hwy., 300–500 m, *Folsom & Maas 5188* (MO); near border with Comarca de San Blas, along El Llano–Cartí road, ca. 340 m, *McPherson 9774* (BM, MO); El Llano–Cartí road, 8–11 km from Inter-American Hwy., 300–400 m, *Mori 7723* (MO); El Llano–Cartí road, 10.8 km from Inter-American Hwy., 1,100–1,200 ft., *Mori & Kallunki 4138* (MO); El Llano–Cartí road, 12.2 km from Inter-American Hwy., ca. 250 m, *Mori & Kallunki 6368* (MO); El Llano–Cartí road, 16–18.5 km by road N of Pan-American Hwy. at El Llano, ca. 400–450 m, *Nee & Tyson 11003* (MO); El Llano–Cartí road, 8–9 mi. from Pan-American Hwy., 250 m, *Sytsma & Andersson 4438* (MEXU, MO). SAN BLAS: El Llano–Cartí road, Km 19, 350 m, *de Nevers, Blake & Herrera 4235* (BM, MO); El Llano–Cartí road, 300 m, *de Nevers & Herrera 4235* (MO); El Llano–Cartí road, 26.5 km along Río Cartí Chico, 200 m, *de Nevers, Herrera & Charnley 5332* (MO).

Distribution. All collections seen are from tropical wet forest in the El Llano–Cartí and Santa Rita Ridge area, from 200 to 500 m.

Specimens of *Ouratea knappiae* have been identified as *O. valerii* Standley. *Ouratea knappiae* differs in the venation and the finely rugose texture of the leaves, and the smaller, depressed-globose, rough and wrinkled torus. *Ouratea valerii* has thinner, smoother leaves that dry a duller, more glaucous brown; the torus is 10–15 mm, obovoid to turbinate, and smooth. *Ouratea valerii* occurs in Honduras, Nicaragua, Costa Rica, and in Panama, west of the Canal, whereas *O. knappiae* is restricted to Panama, east of the Canal. *Ouratea knappiae* is named in honor of Sandra Knapp, one of the collectors of the type specimen.

4. Ouratea osaensis Whitefoord, sp. nov. TYPE: Costa Rica. Puntarenas: high road out of Rincón de Osa, Rincón to 5 km W of Rincón, secondary forest, 0–300 m, 13 Feb. 1974, *R. Liesner 2096* (holotype, MO). Figure 5.

Ab *O. pyramidalis* Riley foliis majoribus latiore ellipticis vel oblongis leviter nitidis, panicula breviore latiore, pedicellis minute verrucosis, drupeolis multo minoribus, differt.

Shrubs 2–3 m high, with slender branchlets. Leaves 21–23 × 6.5–9 cm, broadly elliptic or oblong, the base cuneate or attenuate, the apex acuminate; subcoriaceous, slightly shiny above, dull beneath, drying grayish green or medium-brown, the margin plane, subentire to crenulate; venation crowded, obscure, major secondary veins ca. 12–18 pairs, irregularly spaced, widely arcuate-ascending, immersed or slightly raised or sulcate above, raised beneath, the minor secondary and tertiary venation scarcely raised on both surfaces; petiole 5–10 mm, stout; stipules not seen. Inflorescence ca. 5.5 cm, terminal, broadly paniculate, the lower branches to 7 cm; flowers solitary or borne in widely spaced, stalked clusters of 2–3; pedicel 8–11 mm, slender, the rhachis and pedicel finely striate and minutely prickly-verruculose; flowers not seen. Torus ca. 4 mm, subglobose, drupelets 3 mm, ellipsoid. The fruit characters are described from immature material.

Paratype. COSTA RICA. PUNTARENAS: Rincón de Osa, slopes adjacent to airport, disturbed primary forest, 20–300 m, *Liesner 1862* (MO).

Ouratea osaensis is perhaps most similar to *O. pyramidalis* Riley from southern Mexico, Belize, Guatemala, Honduras, and Panama and *O. insulae* Riley from southern Mexico, Belize, Guatemala, and Honduras, both of which also have paniculate inflorescences, but neither of which occurs in Costa Rica. *Ouratea pyramidalis* has smaller leaves (11–20 × 4.5–7 cm) with a dull surface and a variously toothed margin, whereas *O. osaensis* has a slightly shiny adaxial leaf surface and a subentire to crenate margin. *Ouratea pyramidalis* also has a larger inflorescence (6–18 cm long), with a smooth rhachis and laxer pedicels than *O. osaensis*. *Ouratea insulae* is generally larger, sometimes a tree to 25 m, with larger, more robust panicles (8–27 cm long) with stouter, more spreading branches than *O. osaensis*.

5. Ouratea rinconensis Whitefoord, sp. nov. TYPE: Costa Rica. Puntarenas: Reserva Forestal Golfo Dulce Osa Peninsula, Trocha de La Tarde road, 10 km SW of La Palma, S of Rincón de Osa, primary forest along red clay soil ridge E of the Río Rincón valley, 150–200 m, 28 Apr. 1988, *B. Hammel & R. Robles 16770* (holotype, BM; isotypes, CR, MO). Figure 6.

Ab *O. flexipedicellato* Dwyer foliis nervis secundariis numerosioribus regulatim dispositis acutiore arcuato-as-

Figure 5. *Ouratea osaensis* (*Liesner 2096*, MO).

Figure 6. *Ouratea rinconensis* (*Hammel & Robles 16770*, BM).

cendentibus, calyce ex sepalis duobus tantum constante, differt.

Shrubs ca. 3.5 m high, with slender branchlets, glabrous. Leaves 19.5–23 × 5.5–7 cm, oblanceolate, the base cuneate or narrowly rounded, long-acuminate at the apex; subcoriaceous, the upper surface slightly shiny, drying reddish brown, the margin plane, crenate; major secondary veins 18–25 pairs, penniparallel, spreading-ascending, sulcate above, slightly raised beneath, the minor venation slightly raised on both surfaces; petiole 3–5 mm; stipules 10 mm, caducous. Inflorescence ca. 20 cm, terminating branchlets, narrowly and laxly paniculate, the rhachis slender, with 1–4 longer branches near the base, the lowest branch ca. 7 cm; flowers well-spaced, solitary or more usually in stalked clusters of 3(–5); pedicel 8–10 mm, incrassate upward, rhachis and pedicel smooth; sepals 2, 8 mm long, boat-shaped, coriaceous; flowers not seen. Torus 8 mm, obovoid; drupelets 11 mm, ellipsoid.

Known only from the type collection.

Ouratea rinconensis resembles the Panamanian species *O. flexipedicellata* Dwyer in leaf size and shape and its long, cylindrical inflorescences. The two species can be distinguished easily, because the secondary leaf veins of *O. rinconensis* are penniparallel, whereas those of *O. flexipedicellata* are irregularly spaced along the midrib and crowded toward the margin. The flowers of *O. flexipedicellata* have five sepals, while those of *O. rinconensis* have two. *Ouratea rinconensis* is named after the type locality.

6. Ouratea stenobasis Whitefoord, sp. nov. TYPE: Panama. Bocas del Toro: Punta Peña, vicinity of Chiriquicito, rainforest, ca. 1,000 ft., 7 June 1967, *Lewis, Escobar, MacBryde, Oliver & Ridgway 2173* (holotype, MO; isotype, MO). Figure 7.

Ab *O. flexipedicellato* Dwyer rhachidi breviore graciliore, foliis latiore ovatis nervis secondariis ordinatim penniparallelis, differt. Species foliis lamina basi subito contracta a congeneribus bene distincta.

Shrubs 3–4 m high, with slender flexuous branchlets, glabrous. Leaves 14.5–22 × 5.5–8.5 cm, broadly elliptic or oblong, abruptly narrowed into a 13-mm stalk at the base above the thickened, wrinkled petiole, the apex abruptly acuminate; chartaceous to subcoriaceous, with a dull sheen on both surfaces, drying yellowish brown or greenish, the

margin plane or slightly revolute, crenate, subentire toward the base; major secondary veins ca. 15–18 pairs, arcuate-ascending, penniparallel, sometimes impressed on the upper surface, raised beneath, the minor tertiary venation spreading, immersed; petiole ca. 1 cm; stipules ca. 6 mm. Inflorescence ca. 9 cm, terminal, racemose or with 1–3 short branches near the base; flowers solitary or in well-spaced, pedunculate clusters of 2–3; peduncles ca. 3 mm; fruiting pedicel ca. 10 mm, markedly incrassate upward; flowers not seen, only very small buds present. Torus 9–12 mm, subglobose or obovate; drupelets ca. 12 mm, ellipsoid.

Paratype. PANAMA. BOCAS DEL TORO: La Fortuna area to Chiriquí Grande and the oil pipeline, along dirt road 10 mi. from Continental Divide, just past second large bridge, 1 mi. N from highway, 130 m, *Hammel, McPherson & Sanders 14588* (MO).

Distribution. Both collections are from the Caribbean slope of Bocas del Toro, Panama.

With its narrowly cylindrical inflorescence and oblong leaves, *Ouratea stenobasis* resembles *O. rinconensis* of Costa Rica and *O. flexipedicellata* of Panama, which are also low-elevation species. However, *O. stenobasis* has an inflorescence ca. 9 cm long, whereas the other two species have inflorescences 20–24 cm long. *Ouratea stenobasis* has penniparallel secondary leaf venation, while *O. flexipedicellata* has irregularly spaced secondary venation. *Ouratea stenobasis* can be distinguished from all other species of *Ouratea* by the stalklike base of the leaf, which gives the appearance of a slender petiole above a pulvinus. The specific epithet is derived from this characteristic leaf base.

Figure 7. *Ouratea stenobasis* (*Lewis, Escobar, MacBryde, Oliver & Ridgway 2173*, MO).

7. Ouratea sulcatinervia Whitefoord, sp. nov. TYPE: Panama. Panamá: 10 km N of Magarita on road to Madroño then 3 km W on ridgetop road, forest remnants, 1,800 ft., 31 Jan. 1979, *Hammel 6020* (holotype, MO). Figures 8, 9.

Ab *O. tuerckheimii* J. D. Smith calyce tantum ex sepalis duobus constante, fructibus maioribus, differt.

Shrubs or trees 2–5 m high, with stout flexuous branchlets, glabrous. Leaves 23–37 × 5.5–10(–13) cm, narrowly or broadly oblanceolate, the base narrowly or widely subauriculate, the apex acuminate; stiffly coriaceous, usually slightly glossy on both surfaces, drying reddish or greenish brown, brighter beneath, the margin revolute, subentire or serrulate; venation conspicuous with ca. 20 pairs of major and numerous minor secondary veins usually deeply sulcate above, raised beneath, the tertiary venation very fine, scarcely impressed, immersed, or raised above and scarcely raised beneath; petiole 2–3(–5) mm, stout; stipules 7–8 mm, persistent. Inflorescence 10–29 cm, terminal or terminating short leafy side-shoots, usually paniculate with 1–4 slender rhachises unbranched or with 1–4 spreading-ascending branches, or rarely racemose; paired stipulelike scales 5–7 mm occasionally persistent on the rhachis at and 1–3 cm above the base and at the lower branching points; flowers well-spaced, solitary or 2–3 in shortly stalked or sessile clusters; pedicel 7–12 mm, slender, much thickened in fruit; sepals 2, 8–11 mm long, boat-shaped, coriaceous, the margins not scarious; petals 5, 9–10 mm long, obovate; stamens 10, the anthers 7.5 mm; gynophore 1.0–2.0 mm; style 3–6 mm. Torus 10–15 mm, narrowly or broadly obovoid; drupelets 8–10 mm, ovoid.

Paratypes. PANAMA. COLON: Santa Rita ridge lumber road, *Correa & Dressler 918* (MO); Santa Rita Ridge road, 4 mi. from Transisthmian Hwy. to Agua Clara weather station, ca. 500 m, *Dressler, Berg & Gentry 8834* (MO); Santa Rita Ridge to 8 mi. E of Transisthmian Hwy., to 800 ft., *Dressler, Lallathin & Dwyer 9010* (MO); Santa Rita E ridge, *Dwyer & Correa 8398* (MO); Santa Rita Ridge, 2 mi. from Transisthmian Hwy., *Gentry 1420* (MO); Santa Rita ridge, ca. 12 km from Transisthmian Hwy., *Hammel 3648* (MO); Santa Rita Ridge road, ca. 8 mi. E of Transisthmian Hwy., along trail N of road, 350–440 m, *McPherson & Merello 8254* (MO); Santa Rita Ridge road, ca. 6 km from Boyd–Roosevelt Hwy.,

Figure 8. *Ouratea sulcatinervia*, in flower (*Hammel 6020*, MO).

Figure 9. *Ouratea sulcatinervia*, in fruit (*Davidse & D'Arcy 10106*, MO).

Mori & Kallunki 2149 (MO); Santa Rita ridge, 7 km by road from Transisthmian Hwy., 3 km SE of Puerto Pilon, 200–250 m, *Nee & Hale 9671* (MO); Santa Rita Ridge road, 20 km from Transisthmian Hwy., Santa Rita hills, *Smith & Smith 3431* (F); Santa Rita Ridge road, 20 km from Transisthmian Hwy., 100–1,200 ft., *Sytsma 1104* (MO, MEXU); Santa Rita Ridge road, 18–20 km from Transisthmian Hwy., 1,000–1,200 ft., *Sytsma 2056* (MO). SAN BLAS: El Llano–Cartí road, 20 km from Interamerican Hwy., 100–350 m, *de Nevers, Vespucio & Herrera 3965* (MO). PANAMA: 7 mi. N of Cerro Azul on road to Cerro Jefe, ca. 2,600 ft., *Blum, Godfrey & Tyson 1800* (MO); 2.5 mi. N of Goofy Lake on road to Cerro Azul, *Croat 11528* (F, MO); El Llano road, 3.4 mi. from the highway, ca. 1,000 ft., *Croat 49100* (MO); Cerro Jefe, 700 m, *Davidse & D'Arcy 10106* (MO); Cerro Azul, 2,000 ft., *Dwyer 1371* (MO); 10 mi. from the Pan-American Hwy. on the El Llano–Cartí road, 350 m, *Knapp, Whitten & Huft 4726* (MO); along El Llano Cartí–Tupile road, 12 mi. above Pan-American Hwy., 200–500 m, *Liesner 1233* (MO).

Distribution. All collections are from Panama, from the Santa Rita ridge, the Goofy Lake to Cerro Azul and Cerro Jefe area, and along the El Llano–Cartí road, tropical wet forest to cloud forest, (30–)100–700 m.

Many specimens of *Ouratea sulcatinervia* have been identified as *O. tuerckheimii* J. D. Smith, a species with similar leaves from Mexico and Guatemala. However, the leaves of *O. sulcatinervia* are often shorter and stiffer, with the lateral veins more regularly spaced and more deeply sulcate (from which the specific epithet is derived). *Ouratea tuerckheimii* has two sepals, while *O. sulcatinervia* has five. *Ouratea sulcatinervia* has a torus 10–15 mm long, while that of *O. tuerckheimii* is only 5–10 mm.

8. Ouratea tristis Whitefoord, sp. nov. TYPE: Panama. Panamá: summit of Cerro Jefe and forests along road beyond summit, 26 Aug. 1967, *Hayden 1010* (holotype, MO). Figures 10, 11.

Ouratea podogyno J. D. Smith forma et nervatura foliorum *O. podogyno* J. D. Smith similis sed foliis chartaceis non coriaceis; ab *O. podogyno* rhachidi graciliore, calyce ex sepalis tantum duobus constanti, differt.

Shrubs or trees 1–5 m high, the branchlets slender, glabrous. Leaves 20–38 × 3–6.5 cm, narrowly lanceolate or narrowly ovate-lanceolate, the base cuneate, the apex acute or acuminate; chartaceous, minutely papillose on both surfaces, drying dull greenish brown, the margin sometimes revolute, subentire or sometimes bluntly and widely toothed toward the apex; venation conspicuous, the major

Figure 10. *Ouratea tristis*, in flower (*Hayden 1010*, MO).

Figure 11. *Ouratea tristis*, in fruit (*Sytsma, Hahn & Antonio 2868*, MO).

secondary veins 15–30 pairs, sulcate above, raised beneath, tertiary venation scarcely raised on both surfaces; petiole ca. 5 mm, stout; stipules not seen. Inflorescence ca. 6.5 cm, terminal or axillary, racemose; flowers solitary, widely spaced; pedicel ca. 9 mm, pedicel and rhachis minutely prickly-verruculose; sepals 2, 7 mm long, boat-shaped, thinly coriaceous, persistent; petals 5, ca. 7 mm long, obovate; stamens 10, the anthers 6 mm; gynophore 1.5 mm; style 4 mm. Torus 9 mm, subglobose; drupelets 7 mm, obovoid.

Paratype. PANAMA. PANAMA: Cerro Jefe, 1.5 mi. down right turnoff 6.7 mi. past Goofy Lake, disturbed cloud forest, 700 m, *Sytsma, Hahn & Antonio 2868* (MO).

Ouratea tristis resembles *O. podogyna* J. D. Smith from Guatemala in size and leaf shape; however, *O. podogyna* differs in its coriaceous leaves and 5-sepaled calyx. *Ouratea tristis* is probably allied to *O. crassinervia*, which also has dull, chartaceous leaves, minutely papillate on both surfaces, a racemose inflorescence and a 2-sepaled calyx. However, the leaves of *O. crassinervia* are crowded, 30–54 cm long, oblanceolate, serrate, with the base cordate or subauriculate, while those of *O. tristis* are 20–38 cm long, narrowly lanceolate or ovate-lanceolate, occasionally irregularly toothed towards the apex, with the base cuneate. *Ouratea tristis* is named for its sad, drab appearance.

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A New Species of *Senecio* Section *Dichroa* (Asteraceae–Senecioneae) from Brazil

Elsa Zardini
Missouri Botanical Garden, P.O. Box 299, St. Louis, Missouri 63166, U.S.A.

ABSTRACT. *Senecio serranus* from Paraná, Brazil, is described as new. It is related to *Senecio dichrous* (Bong.) Schultz-Bip., but does not have glandular hairs and does have leaves of the same color on both surfaces. Both species belong to *Senecio* sect. *Dichroa* Cabr. and unlike all other ones of the section, have rayless heads with only one type of floret.

Among the collections made by Gert Hatschbach in the state of Paraná, Brazil, there is an undescribed species of *Senecio* related to *Senecio dichrous* (Bong.) Schultz-Bip. but without glandular hairs and with leaves not paler on lower surface than on upper, which is here described.

Senecio serranus Zardini, sp. nov. TYPE: Brazil. Paraná: Campina Grande do Sul, Serra Capivari Grande, 6 Mar. 1969, *Hatschbach 21212* (holotype, MBM; isotypes, MO, US not seen, distributed as *Senecio dichrous*). Figure 1.

Herba erecta; caule striato profunde sulcato glabro ca. 1 m alto. Folia petiolata alterna; lamina glabra oblonga, basi attenuata, apice acuta, margine grosse dentata, nervis reticulatis. Capitula multa discoidea ad apices ramulorum paniculato-corymbosa; involucro campanulato glabro calyculato ca. 9 mm alto ca. 6 mm crasso; bracteolis calyculi 4–6, lanceolatis, 9–13 mm longis; phyllariis 6–8, oblongo-linearibus, apice acutis. Flosculi ca. 26, lutei, isomorphi, hermaphroditi; corolla tubulosa ca. 10 mm longa, pentadentata. Achaenia (immatura) costata glabra ca. 6 mm longa; pappo albo capillari ca. 10 mm longo.

Erect herb. Stems striate, furrowed, glabrous, 1 m tall. Leaves petiolate, alternate. Blade oblong, attenuate at base, acute at apex, coarsely dentate at margin, with reticulate venation, glabrous or sometimes with evanescent arachnoid tomentum below. Heads many, discoid, in terminal inflorescences paniculate-corymbose. Involucre campanulate, glabrous, 9 mm tall, 6 mm wide, with epicalyx; bracts of the epicalyx 4–6, lanceolate, 9–13 mm long; phyllaries 6–8, linear-oblong, acute. Florets around 26, yellow, isomorphic, hermaphrodite, with tubular corolla 10 mm long, 5-lobed. Achenes (immature) ribbed, glabrous, 6 mm long. Pappus white, capillary, 10 mm long.

Paratypes. BRAZIL. PARANA: Campina Grande do Sul, Pico Caratuva, 8 Feb. 1968, *Hatschbach 18563* (MBM, MO); Serra Capivari Grande, 18 July 1986, *Silva & Zelma s.n.* (US not seen, distributed as *Senecio dichrous*).

Senecio serranus Zardini is similar to *S. dichrous* (Bong.) Schultz-Bip. (basionym, *Cacalia dichroa* Bong. Brazil. Minas Gerais: *Riedel s.n.*, holotype, LE not seen, photo, MO; see Fig. 2), from which it can be differentiated by the following key.

1a. Plants without glandular hairs; leaves of the same color on both surfaces ..... *S. serranus*
1b. Plants with glandular hairs; leaves distinctly paler on lower surface, green above, whitish below ..... *S. dichrous*

These two species belong to *Senecio* sect. *Dichroa*, one of the two sections of the genus characterized by a hairy tuft at the apex of the style. The description of this section (Cabrera, 1957) should be amended to include rayless heads with only one type of floret characteristic of both *Senecio serranus* and *S. dichrous*. The latter species was treated by Cabrera (1957) within section *Dichroa* as doubtful because the type of its basionym, *Cacalia dichroa* Bong., was not seen by him. All the other species of the section have heads with two types of florets, the marginal ones being ligulate.

Acknowledgments. I express special gratitude to G. Hatschbach (MBM), to N. Imkhanitskaya of the Komarov Botanical Institute (LE) for help with the study of the type of *Cacalia dichroa* Bongard, and to A. Cabrera (LP) for reviewing the manuscript.

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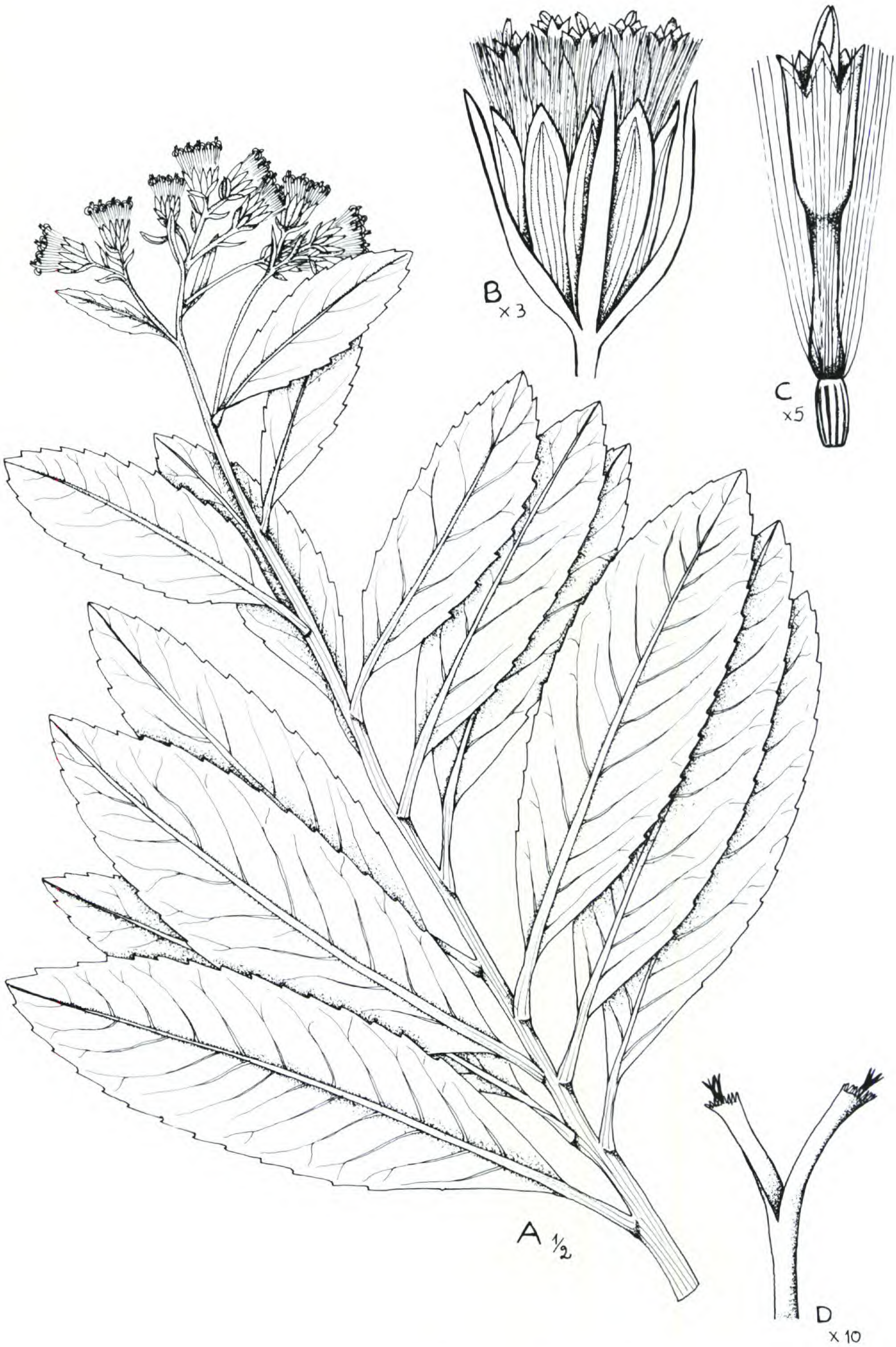

Figure 1. *Senecio serranus* Zardini. —A. Plant. —B. Head. —C. Floret. —D. Style.

Figure 2. Photograph of the holotype of *Cacalia dichroa* (LE).

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Neviusia cliftonii (Rosaceae: Kerrieae), an Intriguing New Relict Species from California

James R. Shevock

Department of Botany, California Academy of Sciences, Golden Gate Park, San Francisco, California 94118, U.S.A.

Barbara Ertter

University and Jepson Herbaria, University of California, Berkeley, California 94720, U.S.A.

Dean W. Taylor

Biosystems Analysis Inc., 303 Potrero Street, Suite 29-203, Santa Cruz, California 95060, U.S.A.

ABSTRACT. A second species is added to *Neviusia* (Rosaceae: Kerrieae), previously known as a single rare species in the southeastern United States. The new species, *N. cliftonii* from northern California, differs from *N. alabamensis* primarily in having petals, fewer stamens, and more broadly ovate, coarsely toothed leaves. The relict nature of *Neviusia* is further supported by newly recognized fossils from the Eocene of British Columbia, Canada.

During the course of conducting botanical investigations in northern California in May 1992, the third author and Glenn L. Clifton stopped at an exposed limestone area on California Highway 299 east of Redding that had intrigued them for several years. At the base of a shaded north-facing slope, they collected a puzzling rosaceous shrub that they could not recognize to genus. It was shown to the senior author, who, after collecting additional material and confirming the shrub as Rosaceae, enlisted the assistance of the second author, who was in the midst of preparing the treatments of several rosaceous genera for *The Jepson Manual: Higher Plants of California*.

After all Rosaceae in various western floras (e.g., Munz, 1959; Hitchcock et al., 1961) were eliminated, the shrub was keyed to tribe Kerrieae in Hutchinson (1964). Kerrieae has usually been circumscribed to include three monotypic genera: *Kerria* DC. and *Rhodotypos* Siebold & Zucc. of eastern Asia, and *Neviusia* A. Gray of the southeastern United States. A comparison with herbarium material at CAS-DS and UC-JEPS indicated that the shrub was unequivocally *Neviusia*, to the extent that an initial suspicion was that the California material represented an escape from cultivation. Subsequent detailed morphological examination, however, supplemented by the discovery of two additional populations the following month, confirmed that it was indeed a distinct new species of *Neviusia*, the first addition to the tribe in 134 years. The key differences follow:

KEY TO THE SPECIES OF *NEVIUSIA*

1a. Petals absent; leaves narrowly ovate to ovate, finely toothed; stamens ca. 100+, 4–7 mm long; sepals 3.5–10 mm long, oblanceolate-obovate to elliptic, with 6+ teeth; style 5–6 mm long; southeastern United States . . *N. alabamensis*

1b. Petals present, white, oblanceolate, 4–6 mm;

leaves ovate to cordiform, coarsely toothed; stamens ca. 50+, 4–5 mm long; sepals 3.5–6 mm long, ± obovate with ≤ 6 teeth; style ± 3 mm long; northern California ..... *N. cliftonii*

Neviusia cliftonii J. Shevock, B. Ertter & D. Taylor, sp. nov. TYPE: United States. California: Shasta Co., along Highway 299 7.4 road mi. W of Round Mountain post office, ca. 25 mi. E of Interstate Highway 5, T34N R1W Sec. 29 NWNW, ca. 1,450 ft. elevation, understory of mesic, north-facing, conifer-dominated forest on Hosselkus limestone, 5 May 1992, *D. W. Taylor & G. Clifton 12513* (holotype, JEPS; isotypes, CAS, GH, MO, NY). Figure 1.

A *N. alabamense* floribus petaliferis (petalis parvis albis), foliis obovato-cordatis grosse dentatis, necnon staminibus circa dimidio minus numerosis ± 50 (nec 100+) 4–5 (vs. 4–7) mm longis differt.

Diffuse slender-branched understory shrub, stems erect, generally several, rarely > 1 cm diam., the bark grayish near base, ± reddish brown above, ± exfoliating in strips, without obvious lenticels; herbage and young twigs ± strigose, the hairs ± 0.4 mm long; leaves alternate, primarily in upper ⅓ of plant, generally expanded at anthesis, the stipules linear-setaceous, free from the 4–10(–15)-mm-long petiole, often with small reddish glands, the leaf blade ovate to cordiform, 2–6(9 on sterile shoots) cm long, 1.5–5(–7) cm wide, ± bicolored, bright green and sparsely strigose above, pallid and more densely strigose below, the venation craspedodromus with 3–8 2° veins per side, the margin coarsely toothed and shallowly lobed, the teeth apiculate; inflorescence ± umbellate-corymbose, terminal, mostly on short side branches, not otherwise pedunculate, the pedicels 1–3 cm long, very slender, ca. 0.3 mm thick (widening above); flowers (1–)3–5(–10), appearing after or with leaves, the hypanthium ± flat, ± glabrous, 2–3 mm diam. (pressed); sepals 5–6, ± obovate, 3.5–6 mm long, 2–4.5 mm wide, veiny, irregularly few-toothed distally, spreading at anthesis, persisting in fruit; petals oblanceolate, 4–8 mm long, white, quickly deciduous; stamens many, ca. 50 or more, ca. equaling sepals, the filaments 4–5 mm long, white, ± dilated, the anthers round, 0.3–0.4 mm long, yellow; pistils 3–6, the ovary densely white-strigose, the style ± 3 mm long, sparsely strigose; fruit ± eccentrically ovoid achene, 3–4 mm long, brown, sparsely strigose.

Paratypes. UNITED STATES. CALIFORNIA: Shasta Co., type locality, 8 May 1992, *Shevock 12127* (CAS, JSU, K, KYO, RSA, UARK, UC, US), 19 May 1992, *Taylor 12584* (HSC, JEPS, KUN, NA), 27 May 1992, *Papalardo & Molter s.n.* (CHSC, Shasta-Trinity National Forest herbarium), 13 June 1992, *Shevock & Ertter 12192* (B, BM, CAS, GH, F, GH, ILLS, JEPS, JSU, LE, MAK, MO, NAS, NY, PR, RM, RSA, TEX, UBC, US, VDB, WTU); along Shasta-Trinity National Forest road 27, 0.6 mi. N of Squaw Creek Forest Service station, T35N R2W Sec. 20 NENE, 1,200 ft., 13 June 1992, *Shevock & Ertter 12197* (ARIZ, CAS, CPH, DAV, JEPS, NCU, NY, OBI, OSC, PE, RSA, SBBG, UC, UCR); along Shasta-Trinity National Forest road 7H009 at Ellery Creek on McCloud River Arm of Shasta Lake, T35N R3W Sec. 6 SE ¼, 1,250 ft., 13 June 1992, *Shevock & Ertter 12199* (CAS, CHR, IBSC, LA, SD, UC).

Eponymy. Named in honor of one of the discoverers, Glenn L. Clifton (1943–), ardent collector of the California and western United States flora. His 30,000 specimens distributed among 6,000 species, including numerous significant collections, form a major portion of the holdings at Pacific Union College (PUA). We suggest "Shasta Snow-wreath" as a euphonious vernacular name, parallel to the established name of "Alabama Snow-wreath" for *N. alabamensis*.

Ecology. The three known occurrences are well spaced around the eastern half of Shasta Lake northeast of Redding, 60–80 km south of Mount Shasta, with an elevation range between 300 and 500 m. All sites are on limestone substrates in shaded cool-air canyons adjacent to creeks; similar situations on other substrates were searched without finding any *Neviusia*. Limestone, relatively rare in northern California, is centered around Shasta Lake, where access to many areas is extremely limited due to the rugged, densely forested terrain with few roads or trails. Limestone is likewise a common substrate for *N. alabamensis*, which also occurs on sandstone, sandy loam, and shale.

The ecological setting in which the *N. cliftonii* populations occur is typically very species-rich, including species at their northern or interior range limit. Associated species include the following: *Acer macrophyllum* Pursh, *Aesculus californica* (Spach) Nutt., *Arbutus menziesii* Pursh, *Aristolochia californica* Torrey, *Asarum hartwegii* S. Watson, *Berberis aquifolium* Pursh var. *dictyota* (Jepson) Jepson, *Calycanthus occidentalis* Hook. & Arn., *Cercis occidentalis* Torrey ex A. Gray, *Clematis lasiantha* Nutt., *Corylus cornuta* Marsh var. *californica* (A. DC.) Sharp, *Cornus sericea* L., *Cornus sessilis* Durand, *Holodiscus discolor* (Pursh) Maxim., *Ligusticum californicum* L. Coulter & Rose, *Lonicera hispidula* Douglas var. *vacillans* A. Gray, *Paxistima myrsinites* (Pursh) Raf., *Philadelphus lewisii* Pursh subsp. *californicus* (Bentham) Munz, *Physocarpus capitatus* (Pursh) Kuntze, *Polygala cornuta* Kellogg, *Prunus subcordata* Bentham, *Pseu-*

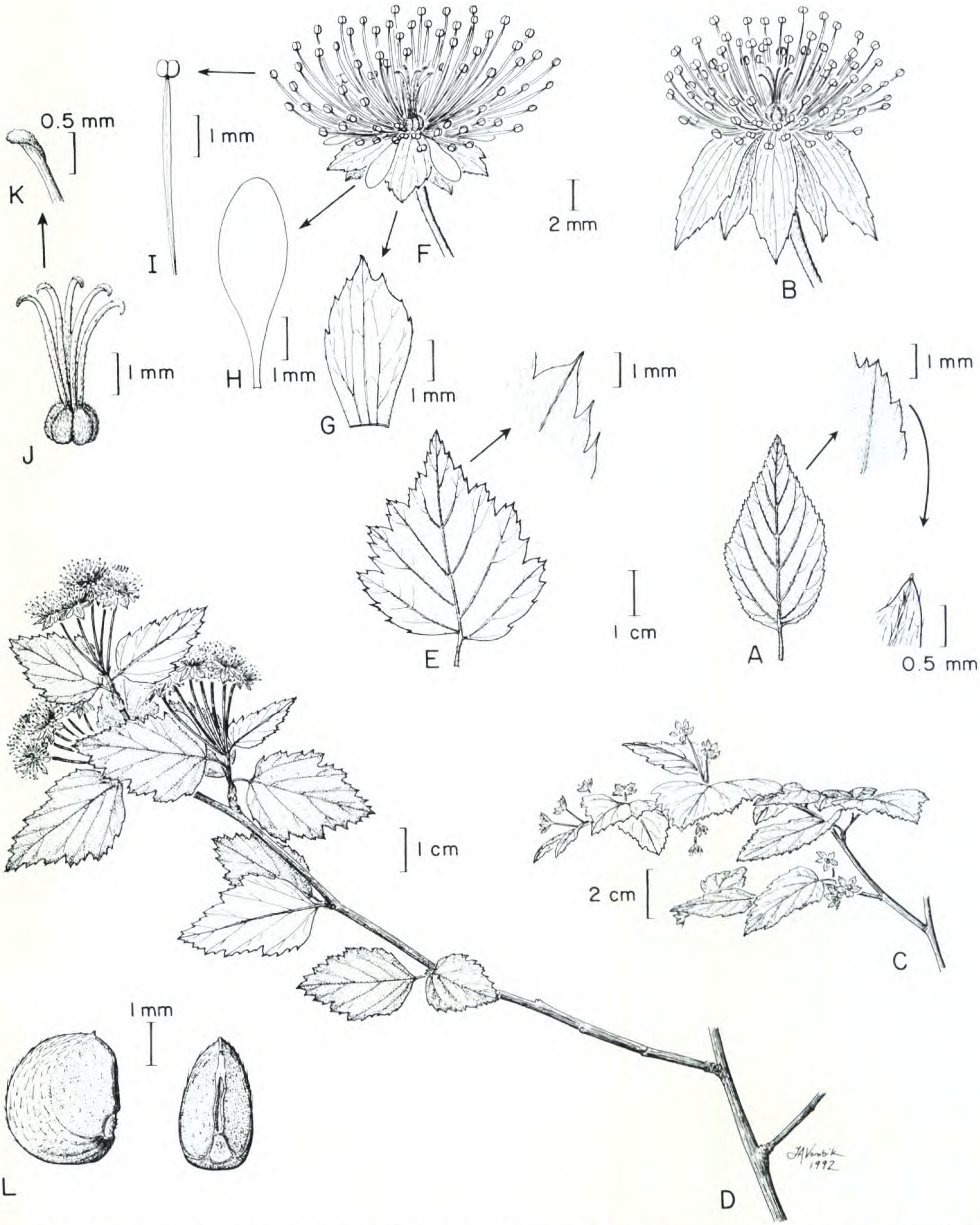

Figure 1. *Neviusia cliftonii* and comparison to *N. alabamensis*. A, B. *N. alabamensis*. —A. Leaf, with details of margin. —B. Flower. C–L. *N. cliftonii*. —C. Habit in life. —D. Branch (pressed). —E. Leaf, with details of margin. —F. Flower. —G. Sepal. —H. Petal. —I. Anther. —J. Gynoecium. —K. Stigma. —L. Achene.

dotsuga menziesii (Mirbel) Franco, *Quercus chrysolepis* Liebm., *Q. garryana* Hook. var. *breweri* (Engelm.) Jepson, *Q. kelloggii* Newb., *Q. wislizenii* A. DC., *Rosa gymnocarpa* Nutt., *Smilax californica* (A. DC.) A. Gray, *Styrax officinalis* L. var. *californica* (Torrey) Rehder, *Symphoricarpos albus* (L.) S. F. Blake var. *laevigatus* (Fernald) S. F. Blake, *Toxicodendron diversilobum* (Torrey & A. Gray) E. Greene, *Trientalis latifolia* Hook., *Vitis californica* Bentham, and *Whipplea modesta* Torrey.

Although the three known sites are relatively

accessible and *N. cliftonii* occurs there as a dominant understory shrub, it is still possible that the species may never have been previously collected. There are no misidentified CAS, DS, JEPS, or UC holdings of *Physocarpus* Maxim. (the genus it is mostly likely to be mistaken for, as it was in Arkansas (Moore, 1956)), *Holodiscus* Maxim., or *Spiraea* L. One potential cause is the prominent co-occurrence of poison-oak, *Toxicodendron diversilobum*, sufficient to discourage casual exploration. In addition, at the type locality along Highway 299 crossing Cedar Creek during peak flows can be difficult; however, 1992 marks the fifth year of drought in northern California.

Relationships. Kerrieae is a distinctive tribe characterized by serrate or imbricate persistent sepals, numerous stamens arranged in several series, and 1–8 drupaceous achenes (Baillon, 1869). As discussed by Robertson (1974), the tribe is morphologically intermediate between subfamilies Spiraeoideae and Rosoideae.

Neviusia alabamensis is apetalous and has 2–4 carpels; it is restricted to the southeastern United States. *Kerria japonica* (L.) DC., with five showy yellow petals and 5–8 carpels, is native to China and Japan. *Rhodotypos scandens* (Thunb.) Makino, also native to eastern Asia, has opposite leaves, large white petals, and 1–4 carpels. Hutchinson (1964) placed *Rhodotypos* in its own tribe, Rhodotypeae, based on the opposite leaves (unusual in Rosaceae) and two ovules per carpel.

Biogeographic significance. Neviusia cliftonii is a remarkable addition to the California Floristic Province. The immediate interpretation is that *Neviusia* is an old, formerly widespread genus with relicts in forest refugia separated by the uplift of the western Cordillera and the formation of the Great Plains. It is therefore immensely satisfying that, by serendipity, Wolfe and Wehr's (1988: 181) recent work came to our attention, wherein a fossil "aff. *Kerria*" is mentioned from early middle Eocene montane assemblages in the Pacific Northwest. Wolfe's suspicion (pers. comm.) that this fossil, from the Princeton flora of southern British Columbia, was probably closest to *Neviusia* was confirmed when he was given the opportunity to examine leaves of *N. cliftonii*. This also supports previous speculations that *N. alabamensis* is an epibiotic, relatively old relict species, whose current distribution follows the former edge of the Mississippi embayment of the old Gulf Coastal Plain (Moore, 1956; Robertson, 1974).

Similar California–eastern United States disjunctions are well known (Sharp, 1951; Wood, 1970); e.g., *Torreya*, *Dirca*, and *Calycanthus*. *Neviusia cliftonii* occurs at the southeastern edge of Klamath-Siskiyou province of northern California, which contains the maximum concentration of arcto-tertiary relicts in California (Raven & Axelrod, 1978: 55–57). Counterparts to California–eastern North American relicts are also often present in eastern Asia, including *Torreya* and the Taxodiaceae. In the case of *Neviusia*, this would be the genus *Kerria* of Japan and China (Fernald, 1931). Several associates of *N. cliftonii* also represent this pattern to a greater or lesser extent.

Rarity Status. Based on the known distribution and extent of potentially suitable habitat, we believe that *N. cliftonii* will prove to be a relatively restricted and rare endemic in the Shasta Lake area. Mining is a very real potential threat; the Hosselkus formation is a high-quality source material for cement production and is the only such limestone in northern California (Bowen et al., 1973). Many accessible deposits throughout the region have already been mined. In addition, a recent major forest fire came perilously close to wiping out the type locality before the species was even described. We therefore recommend that *N. cliftonii* be considered as a candidate for the next addition to the U.S. Fish and Wildlife Service Notice of Review of plant taxa for listing as Endangered and Threatened Species in the *Federal Register*. It will be included in future editions of the California Native Plant Society's *Inventory of Rare and Endangered Vascular Plants of California*.

Neviusia alabamensis is also a candidate for either threatened or endangered status in the *Federal Register*. It is known from two sites in Alabama, three in Arkansas, three in Tennessee, one in Georgia, and one in Mississippi (element records from The Nature Conservancy, Arlington, Virginia). An occurrence in Missouri is presumed extirpated, as is the type locality in Alabama; goats are a potential threat to some extant populations (Rogers & Wilmes, 1989).

All three genera of Kerrieae are currently in cultivation. *Neviusia alabamensis*, in cultivation since its discovery in 1858 (Howard, 1976), has recently been promoted for native plant gardens (Rogers & Wilmes, 1989). It is generally propagated from softwood cuttings and is hardy as far north as Chicago and Boston. Cuttings and seeds of *N. cliftonii* have been given to the University of California Botanical Garden, a member of the Center for Plant Conservation.

Acknowledgments. The full significance of this exciting discovery has been amplified by the contributions of many other people, all of whom have

earned our deepest appreciation. Paleobotanists Jack Wolfe, Wesley Wehr, and Howard Shorn provided us with a fossil history of *Neviusia*. Forest Service botanist Julie Kierstead Nelson acquired maps showing limestone outcrops around Shasta Lake. David Whetstone of JSU gave us additional information on the morphology and ecology of *N. alabamensis*, as did The Nature Conservancy staff in Arlington, Virginia. Kenneth Robertson provided valued reviewer's comments. Linda Vorobik was able to fit a "need-ASAP" illustration into her crowded schedule, with no sacrifice of her usual high quality. Dieter Wilken granted an exemption to the "absolutely no more additions" barrier for including new discoveries in the *Jepson Manual*. Last, but certainly not least, Rupert Barneby checked and corrected the Latin, sharing our enthusiasm for this discovery.

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Eleven New Species, a New Variety, and a New Varietal Combination in the Fern Genera *Asplenium* and *Diplazium* in Central America

C. Dennis Adams

British Museum (Natural History), Cromwell Road, London, SW7 5BD, United Kingdom

ABSTRACT. The following new taxa of ferns, *Asplenium barclayanum*, *A. salicifolium* var. *aequilaterale*, *A. seileri*, *Diplazium atirrense* var. *lobulatum*, *D. chimuense*, *D. chiriquense*, *D. croatianum*, *D. gomezianum*, *D. hammelianum*, *D. matudae*, *D. moranii*, *D. panamense*, *D. tutense*, have been revealed through research carried out in the preparation of contributions for *Flora Mesoamericana*.

Asplenium barclayanum C. D. Adams, sp. nov. TYPE: Costa Rica. Isla del Coco: "Cocos Island," 3–7 Apr. 1838, *Barclay 2196* (holotype, BM). Figure 1.

Filix *A. cristati* Lam. affinis sed lamina basin versus sensim contracta, pinnis mediis lanceolatis (non oblongis), pinnula basali singulari libera 2–4-lobata, rhachidi viridialata, apicem versus ad 1 mm plusve dilatata differt.

Rhizome 1–3 × 0.2–0.4 cm, suberect or shortly creeping; scales 1–5 × 0.2–0.8 mm, elongate-deltate from a rounded auriculate base, tapered to a short hair tip, remotely denticulate, flat or slightly crispate, clathrate, dark brown or blackish with narrow paler margins, slightly lustrous, eventually reticulate, clustered over rhizome apex and extending to base of petiole only; leaves 11–38 cm long, tufted or closely approximate; petiole 2–8 cm long, purplish or grayish brown, narrowly green-winged from near base, brittle with residual vascular shreds; blade 9–30 × 2–5.5 cm, 2-pinnate-pinnatifid, lanceolate, gradually narrowed to base, with apex shortly acuminate, nonconform; rachis green-winged adaxially, widening at pinna bases and laterally to ca. 1 mm or more overall below the tip, confluent with pinna-bases on the basiscopic side, rounded and purplish brown abaxially, becoming stramineous or green distally, with a few short glandular hairs near junctions with pinnae; pinnae 0.5–3 × 0.4–1.2 cm, the longest submedial, stalked to less than 1 mm long, 15–30 pairs, obliquely deltate to lanceolate in outline, with a distinct 2–4-lobed pinnule proximally on the acroscopic side and up to 6 uniform pairs of simple or shortly forked lobules; costae prominent adaxially, winged throughout; proximal pinnules 3–5 × 2–4 mm, subflabellate; terminal segment linear, ascending-lobulate; ultimate segments to ca. 4 × 1 mm, linear or oblong, obtuse or emarginate, herbaceous, glabrescent, scarcely discolorous; veinlets simple or 1-forked in the lobed segments, evident, ending in linear hydathodes well short of margins; sori 0.5–3 mm, solitary or double and sometimes continuous around the veinlet-tip; indusia 0.4–0.5 mm wide, hyaline, colorless or light brown with broadly rounded entire or shortly erose margin, gaping and pocketlike at maturity; spores ca. 42 × 30 μm, light brown, reniform-ellipsoid with loose, unsculptured, sparsely rugose perispore.

Paratypes. COSTA RICA. ISLA DEL COCO: along brook flowing into Wafer Bay, ca. 700 ft., abundant on walls of cliffs, 19 Apr. 1930, *Svenson 339* (MO); rivulet flowing into Chatham Bay, Mar. 1970, *Gómez 3337* (F); sin. loc., *Menzies s.n.* (K).

This species has been collected several times on the Isla del Coco and has been aligned with *Asplenium macraei* Hook. & Grev. (Svenson, 1938; Gómez, 1975). A sheet seen by Svenson at Kew and filed with the holotype of *A. macraei* carries a mixture of collections comprising a piece of *A. myriophyllum* from Galápagos, a small withered leaf collected by Macrae which may or may not be *A. macraei*, and three leaves of another *Asplenium*, annotated "Asplenium Owhyhee A. M.," which led Svenson to believe that his collection from Cocos Island was also *A. macraei*. It has been confirmed by E. W. Groves that these three leaves were not collected by Macrae, but rather by Alexander Menzies on Cocos Island on 26 Jan. 1795, and he agrees with me that they do not represent that species.

Asplenium macraei seems to be a polymorphic species within the Hawaiian Islands, but the type comes closer to *A. sciadophilum* Proctor than to *A. barclayanum*, which has the ultimate segments linear or elliptic, rather than oblanceolate-oblong, with more open evenly spaced sinuses and a more broadly winged upper rachis. Other species of the affinity of *A. cristatum*, but with the blade narrowed gradually to the base, are *A. cladolepton* Fée and *A. myriophyllum* (Sw.) C. Presl. They both differ from *A. barclayanum* in having up to seven pairs of pinnules per pinna rather than a single free proximal acroscopic pinnule on the larger pinnae.

Collections from Isla del Coco, cited by Gómez

(1975: 43), but which have not been seen for this study, are *Gómez 4536* (CR, US), *Pittier 16235* (GH), and *Snodgrass & Heller 954* (GH).

Asplenium salicifolium L. var. **aequilaterale** (Christ) C. D. Adams, comb. nov. Basionym: *Asplenium auriculatum* Sw. var. *aequilaterale* Christ, Bull. Soc. Roy. Bot. Belgique 35: 197. 1896. TYPE: Costa Rica: *Biolley 2672* (lectotype, selected here, BR).

This variety differs from the type variety by the petiole drying brown rather than grayish green; the pinnae being almost equilateral with rounded auricles on both acroscopic and basiscopic sides rather than strongly inequilateral with the proximal acroscopic margin rounded-auriculate and the basiscopic margin subrectangular; the pinnae being more numerous with up to 22 pairs instead of fewer than 17 pairs, and herbaceous and discolorous rather than subcoriaceous and concolorous.

Additional specimens examined. COSTA RICA. SAN JOSE: W part of montañas Jamaica, ca. 3 km NE of Bijagual de Turrubares, Carara Reserve, 9°45.5′N, 84°33′W, 500–600 m, 7 Aug. 1985, *Grayum et al. 5834* (MO). PANAMA. LOS SANTOS: Loma Prieta, Cerro Grande, 800–900 m, 8 June 1967, *Lewis et al. 2238* (MO).

Asplenium seileri C. D. Adams, sp. nov. TYPE: El Salvador. Laguna Verde, terrestrial in forest, 1,650 m, *Seiler 957* (holotype, F).

Figure 1. *Asplenium barclayanum* C. D. Adams.

Filix *A. otitis* Link affinis sed pinnis minoribus (2–4 mm latis), marginibus crenis late rotundatis interdum emarginatis, textura submembranacea differt.

Rhizome 1–1.5(–4.5) × 0.2–0.3 cm, erect; scales 1.5–2.5(–3) × 0.4–0.7 mm, linear-lanceolate, tapered to a hair tip, flat or subcucullate, slightly sinuate, remotely denticulate, clathrate, dark brown or black, lustrous, extending in smaller forms to petiole; leaves 7.5–20 cm long, tufted, monomorphic; petiole 0.5–4 cm long, flexuous, green-marginate or winged to 0.25 mm wide from near base, dark purplish brown and lustrous abaxially, with few appressed septate hairs extending to rachis and abaxial surface of lamina, brittle, scarcely leaving vascular shreds; blade 7–17 × 1.4–2.3 cm, 1-pinnate, linear-elliptic, narrowed to base, the tip long-acuminate, nonconform pinnatifid, then linear-caudate, regularly crenate-serrate; rachis with 2 patent green adaxial wings (to ca. 0.2 mm wide) interrupted at junctions with pinnae and confluent with their margins, rounded and dark purplish brown abaxially; pinnae 4–12(–14) × 2–4 mm, the longest medial, shortly (less than 0.3 mm) cartilaginous-stalked to sessile only distally, 18–32 pairs, obliquely oblong, the lowest deflexed and subflabellately equilateral, the others inequilateral, the upper patent or slightly ascending, shortly auriculate on the acroscopic margin, the cuneate proximal margins mostly slightly excavate, the acroscopic edge ± contiguous with the rachis, the basiscopic extending at least halfway to the obtuse dentate tip, the other margins with 3–5 broadly rounded, sometimes emarginate, shallow crenations, the costae scarcely more prominent than the veins, submembranaceous, discolorous; veinlets mostly simple, a few 1-forked on the acroscopic side and 2-forked in the auricles, evident, ending in conspicuous elongate-clavate hydathodes well within the margins; sori 0.5–1.5(–2) mm, regularly disposed, extending into the caudate leaf apex, rarely double; indusia ca. 0.4 mm wide, hyaline, greenish or brownish, entire, folded back and often completely obscured by sporangia at maturity; spores 34–35 × 23–25 μm, light brown, reniform-ellipsoid with loose irregularly ridged echinulate perispore.

Paratypes. EL SALVADOR. AHUACHAPAN: terrestrial on forest floor, Sierra Apaneca, SW of Apaneca village, 1,600 m, *Molina R. & Montalvo 21797* (F). COSTA RICA. PUNTARENAS: terrestrial, Upper Río Buru, *Gómez et al. 21783* (MO).

The name *Asplenium vicentinum* Maxon was used for this species by Standley & Calderón (1925: 21) and Calderón & Standley (1944: 29), based on *Standley 21574* (US), and Seiler (1980: 49) in lists. These uses were not accompanied by descriptions, and I have been unable to ascertain that the binomial was formally published elsewhere.

Diplazium atirrense (J. D. Smith) Lellinger var. **lobulatum** C. D. Adams, var. nov. TYPE: Costa Rica. Alajuela: Finca Los Ensayos, ca. 11 mi. NW of Zarcero, 850 m, 15 Aug. 1977, *Croat 43638* (holotype, MO; isotype, MEXU).

Pinnae per ⅓–½ distantiae ad costam in segmenta rotundata cum areolis costalibus saepe consociata partitae.

Paratypes. COSTA RICA. PUNTARENAS: Cañas Gordas, Valle de Agua Buena, 1,100 m, Feb. 1897, *Pittier 10968* (BR). PANAMA. CHIRIQUI: along road between Gualaca and Fortuna Dam site, 10.1 mi. NW of Los Planes de Hornito, 1,260 m, 82°17′W, 8°45′N, 10 Apr. 1980, *Antonio 4176* (MO); same locality, *Croat 50043* (MO).

The new variety is distinguished from variety *atirrense* by having the pinnae, at least at the base of the leaf, divided ⅓–½ of the distance from the margin to the costa into round-tipped segments, which are often associated with costal areoles. The typical variety has entire or subentire pinnae and forms regular flattened areoles along the mid-upper rachis-wing and elsewhere only casually.

Diplazium chimuense C. D. Adams, sp. nov. TYPE: Costa Rica. Limón: ridge between Cerro Chimú and Cerro Matama, terrestrial, 1,200 m, 29 Apr. 1985, *Gómez & Herrera 23544* (holotype, MO). Figure 2.

Diplazium foliis pinnatis, pinnis lateralibus subintegris 2–5-jugatis; pinna terminali libera 1–2-lobata, venulis anastomosantibus.

Rhizome ca. 1 cm thick, suberect; scales ca. 7 × 2.5 mm, ovate, shortly acuminate, somewhat saccate, with irregularly toothed margins, dark brown, clathrate, fenestrated, glossy; leaves 40–80 cm long, loosely tufted; petiole 18–40 × ca. 0.2 cm, purplish brown, scaly and darker near base, like the rachis and costae puberulous; blade 22–40 × 14–20 cm, 1-pinnate, ovate-deltate, acuminate; lateral pinnae 10–14 × 3.5–4.5 cm, 2–4(–5) pairs, oblong-lanceolate, broadly and slightly unequally cuneate to subtruncate or rounded at base with stalk to 6 mm, the margins shallowly sinuate, the short- or long-acuminate tip subentire with minute serrations obscured by downfolding; terminal pinna 16.5–18 × 4–5.5 cm (not including width of basal lobes), lanceolate, acuminate, with 1 or 2 ovate, acuminate basal lobes; lamina glabrous; midribs corrugate and glabrescent abaxially; adaxial groove narrow, puberulous within, winged on both margins; veinlet-groups about 20 on each side of costa, 2–4(–5)-forked, with anastomoses between adjacent proximal branches more frequent toward the margin; veinlet-groups toward base of terminal pinna pinnate, up to 10-forked; sori to 15 mm, often linked on proximal veinlets, mostly double; indusia 0.3–0.4 mm wide including margin, fimbriate and ciliate with septate hairs, brown, glossy.

Paratypes. COSTA RICA. ALAJUELA: Univ. of San Ramón's Biological Field Station, ca. 20 km N of San Ramón, cloud forest, 10°15′N, 84°30′W, 800–900 m, 27 Feb. 1988, *Moran 4150* (MO, UC). HEREDIA: forest between Río Peje and Río Sardinalito, Atlantic slope of Volcan Barva, locally common on slopes in rich primary forest, 10°17.5′N, 84°04.5′W, 700–750 m, 2 Apr. 1986, *Grayum 6679* (MO, UC); ca. 30 km from San Ramón on road to Los Angeles Norte, wet cloud forest, ca. 2,000 ft., 10 July 1972, *McAlpin 1308* (CAS).

Among the Central American species with anastomosing veinlets, this is the only one with several pairs of entire lateral pinnae and a more or less conform terminal pinna.

Diplazium chiriquense C. D. Adams, sp. nov. TYPE: Panama. Chiriquí: Bajo Boquete, Finca de T. Rios, terrestrial on bank of streamlet, 2,000 m, 7 Sep. 1982, *Caballero 200* (holotype, MO). Figure 3.

Filix *D. franconis* Liebm. affinis sed stipite rhachidique brunnea (non straminea) et multo magis squamata, pinnulis vel pinnularum segmentis paribus 7–11 (non 13–15 plusve) disposita, etiam pinnis prope bases gemmiferis differt.

Rhizome to 7 × 2 cm, erect or ascending; scales 3–10 × 1–2.5 mm, lanceolate, acuminate, subentire or glandular-denticulate, twisted and curled, brown or blackish brown, subclathrate; leaves 45–120 cm, openly tufted in a short spiral; petiole 20–55 × 0.2–0.5 cm, like rachis and costae brown or reddish brown, glabrous; scales at base of petiole spreading, clathrate, extending in smaller ragged, deltate, or polygonal forms to costules and veins abaxially; adaxial groove sparsely puberulous, glabrescent or with a few dark hairlike scales; blade 25–75 × 10–27 cm, 2-pinnate or 2-pinnate-pinnatifid (proximally at base), ovate-lanceolate, long-acute; pinnae 4–13(–16) × 1.5–4(–5.5) cm, 12–16(–18) pairs, lanceolate, usually alternate, long-caudate acuminate, the basal slightly shorter, stalked to 4 mm with, at least on mid and upper ones, a small, rounded, dark, scaly bud on the acroscopic side, incipient buds also on some adaxial surfaces on costules or veins; pinnules (one pair proximal on basal and mid pinnae only) 1–3 × 0.7–1.7 cm,

Figure 2. *Diplazium chimuense* C. D. Adams.

Figure 3. *Diplazium chiriquense* C. D. Adams.

elliptical to ovate, entire or pinnatifid to halfway to costule; other pinna-segments 0.5–2.5 × 0.5–1 cm, 8–10 pairs, ovate or oblong, obtuse or more usually acute, often quite strongly falcate, shortly lobed, crenate or serrulate, glabrous, herbaceous, green, weakly discolorous; veinlets in larger segments arbuscular, alternate in 4–8 pairs, the proximal often again forked; sori to 6(–8) mm, mainly on acroscopic branchlets, double and single (distally); indusia 0.6–0.8 mm wide, dark brown with paler entire undulate margins, folded back at maturity.

Paratypes. PANAMA. CHIRIQUI: along stream near trail N of Cerro Punta, terrestrial, 29 May 1970, *Croat 10449* (MO); Guadalupe, Cerro Punta, Finca Maduro, terrestrial, 2,000 m, Mar.–Apr. 1982, *Caballero 81, 137, 138* (MO).

This fern has the affinity of *D. franconis* but the stipe distally and the rachis are brown rather than straw-colored and much more scaly; the pinnae have fewer (7–11 instead of 13–15 or more) pairs of pinnules or pinnular segments, and the mid and upper pinnae bear small, dark, scaly buds near their bases on the acroscopic side.

Diplazium croatianum C. D. Adams, sp. nov. TYPE: Panama. Coclé: La Mesa, above El Valle de Anton, ca. 2 km W of Cerro Pilón, on slopes of steep knifelike ridge, cloud forest, terrestrial, 900–930 m, 22 July 1976, *Croat 37501* (holotype, MO). Figure 4.

Affinis *D. diplazioidis* (Desr.) Alston sed indusiis pallidis (non atrobrunneis) margine ciliis multo longioribus (ca. 1 mm) quam membranae basalis latitudine (ca. 0.3 mm) instructo differt.

Rhizome unknown; scales (on petiole base) 3–6 × 1–2 mm, elongate-deltate, acuminate to slender curled tips, denticulate-margined, black, shiny, clathrate; leaves to 145 cm long; petiole 60 cm long, brownish black, shiny, minutely puberulous; blade 85 × 50 cm, 2-pinnate-pinnatifid, deltate; rachis, costae and costules dark brown to black with numerous hair-tipped, sinuate, toothed scales, puberulous at least on major axes abaxially, glabrescent, shiny; adaxial groove glabrous or thinly scaly, the wings interrupted and lobed at junctions; pinnae to 30 × 13 cm, ca. 10 pairs, subopposite, ovate-lanceolate, equilateral, stalked to 2 cm; pinnules to 6 × 2 cm, to ca. 12 pairs, shortly stalked, lanceolate, the proximal slightly shorter, alternate, cut ⅔–¾ to the costule into 5–9 pairs of sessile segments; ultimate segments to ca. 8 × 3.5 mm, the basal basiscopic usually the largest, oblong, patent or antrorse, repand or crenulate, glabrous, membranaceous, scarcely discolorous; veinlets to 5 pairs in

Figure 4. *Diplazium croatianum* C. D. Adams.

Figure 5. *Diplazium gomezianum* C. D. Adams.

the larger segments, simple, widely divaricate, black, ending in hydathodes mostly reaching the margin; sori very small (to ca. 3 mm) with 2 or 3 sporangia each; indusia to 0.3 mm wide with membranous light brown base and fimbriate margin with curled, septate cilia to 1 mm long.

Besides its affinity with *D. diplazioides*, this species also comes close to the recently described *D. entecnum* Mickel & Beitel (1988: 154), but proliferating buds at the bases of some of the pinnules are lacking and the uncut part of the indusia is much narrower. *Diplazium laciniatum* Mickel & Beitel (1988: 156) is also close, but the pinnae of that species have much shorter stalks, and the axes are not puberulous.

Diplazium gomezianum C. D. Adams, sp. nov. TYPE: Costa Rica. Puntarenas: road to Puerto Jiménez, Osa, 40 km W of I.A. route 2, 100 m, *Gómez 19533* (holotype, MO). Figure 5.

Filix *D. herbacei* Fée affinis sed foliorum axibus pubescentibus squamatisque, pinnulis subsessilium, segmentis majoribus petiolulis brevioribus insidentibus, hydathodis a margine remote terminantibus, indusiis integris vel subintegris (nec fimbriato- nec glanduloso-marginatis) differt.

Rhizome shortly creeping; scales to 15 × 0.5–1.5 mm, linear, long-attenuate, tapered to one cell or pair of cells, subentire, remotely denticulate, brown, shiny, subclathrate; leaves 1.5–3 m long or more; petiole 50–120 cm long or more, slightly darker, pubescent and scaly at base; pneumatophores white; rachis and costae with small dark brown scales; minor axes chaffy with hairlike, ragged or stelliform scales and minute reddish glandular hairs; blade 100–150 × 75–100 cm or larger, 3-pinnate-pinnatifid, ovate; adaxial groove puberulous proximally, glabrous distally, with wings interrupted and shortly lobed at junctions, thinly herbaceous, uniformly green; pinnae 30–60 × 12–30 cm, the basal slightly shorter, alternate from purplish pulvini, equilateral with stalks to 3 cm, ovate to oblong-ovate, acute; pinnules to 15 × 4 cm, 14–20 pairs, fully pinnate with short stalks or more usually sessile with continuous lamina, less than 2 cm apart, perpendicular to the costa, oblong-lanceolate, acuminate; divisions of the third order 10–20 × 5–8 mm, 8–12 pairs, obliquely oblong, adnate at unequal attachment to costule, with a cleft sinus on acroscopic base and a lobe to 3 × 2.5 mm, and a rounded sinus at basiscopic base, with 5–7 pairs of rounded, doubly crenate, slightly oblique lobes

cut one-third to nearly halfway to midvein; veinlets 1–2(–3)-forked in each segment-lobe; sori to 4 mm, up to 7 pairs in each segment, double on proximal veinlet and acroscopic branch, single distally; indusia 0.3 mm wide, oblong, brown, entire or subentire, perpendicular at maturity.

Paratypes. MEXICO. CHIAPAS: Finca Mexiquito, July 1913 (st), *Purpus 7112* (UC). COSTA RICA. La Palma, 1,500 m, 24 Sep. 1905, *Werckle 17103* (P). PUNTARENAS: Cantón de Buenos Aires Ujarrás, headwaters of Río Kuiyé following the ridges that overlook Olán, 9°17′50″N, 83°14′45″W, 1,450 m, 20 Sep. 1989, *Herrera 3507* (CR not seen, MO).

Some Central American collections have been identified as *D. herbaceum* Fée (Smith, 1981: 96). That Brazilian plant differs in several respects, particularly in having the stipe, rachis, and minor axes glabrous, the pinnules longer-stalked, the ultimate segments smaller and more distinctly stalked, the hydathodes reaching to or very close to the margins, and the indusia being fimbriate-ciliate and glandular-margined.

Diplazium hammelianum C. D. Adams, sp. nov.

TYPE: Panama. Bocas del Toro: La Fortuna area, ca. 2 mi. N of continental divide, in forest along stream and on ridge above road, 8°46′N, 82°15′W, 950–1,100 m, 7 Mar. 1986, *Hammel et al. 14659* (holotype, MO). Figure 6.

Filix *D. gomeziani* C. D. Adams affinis sed laminae textura membranacea (non herbacea), divisionibus pinnatifidis ordinis tertii duplo longioribus sesquilatioribusque, segmentis oblongis (non rotundatis) fere ad costulas incisis differt.

Rhizome shortly creeping, ascending; scales to 10 × 3 mm, lanceolate, long-attenuate to a hairlike tip terminated by a knot of cells, subentire or irregularly lobed, not toothed, light tan to yellowish brown, very shiny, subclathrate, not retiform; leaves ca. 2 m long; petiole 85 cm long, not much darkened at scaly base, glabrous, into rachis stramineous and sparsely puberulous; costae and costules with a few small, ragged, appressed scales abaxially; blade 110 × ca. 90 cm, 3-pinnate-pinnatifid to nearly 4-pinnate, broadly ovate, openly divided, membranaceous, dark green; adaxial groove minutely puberulous proximally, glabrous distally, the wings interrupted and shortly lobed at junctions; pinnae to 60 × 30 cm, to ca. 11 pairs, alternate from purplish pulvini, to ca. 9 cm apart on rachis, equilateral with stalks to 8 cm long, ovate, acute; pinnules to 18 × 8 cm, ca. 12 pairs, alternate to 2–2.5 cm apart on the costa, stalked to ca. 8 mm or less, oblong-lanceolate, acuminate; divisions of the third order

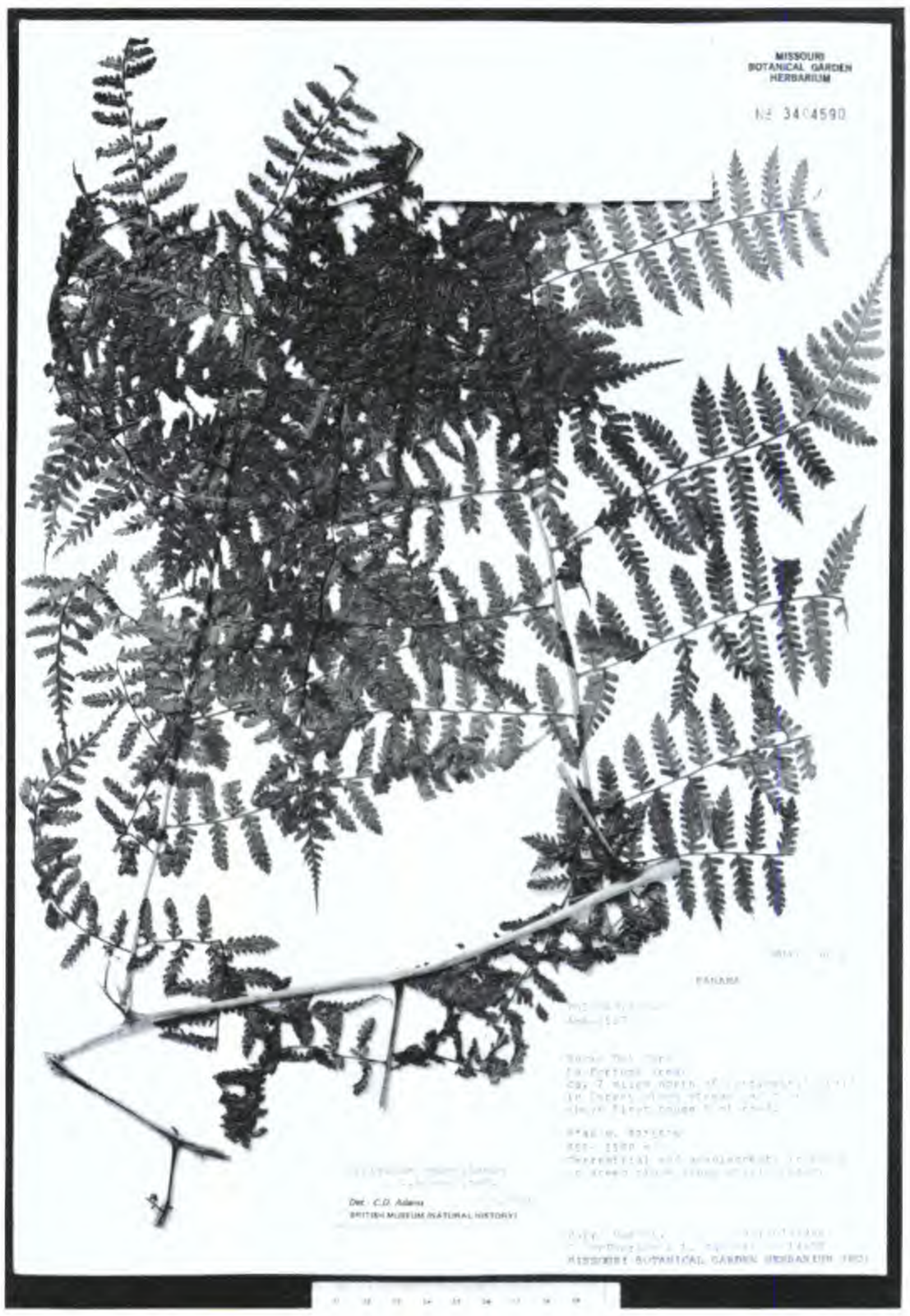

Figure 6. *Diplazium hammelianum* C. D. Adams.

1–4 × 0.7–1.2 cm, up to 4–10(–12) pairs, the proximal stalked, oblong, acuminate, cut over halfway or nearly to the midrib into alternate segments, the lamina continuous to the costa but not to its base; ultimate segments 3–7 × 2–2.5 mm, 7–9 pairs, oblong, oblique, crenate-serrate; veinlets (2–) 4–5(–6)-forked in the segments, strongly antrorse; sori 1–4 mm, single on the acroscopic veinlets; indusia 0.2 mm wide, tapered at both ends, dark yellowish brown, entire.

Diplazium hammelianum is a large fern resembling *D. gomezianum* C. D. Adams but with the texture of the lamina tissue membranaceous rather than herbaceous and the pinnatifid divisions of the third order being about twice as long and half again as wide with oblong rather than rounded segments cut nearly to the midvein.

Diplazium matudae C. D. Adams, sp. nov. TYPE: Mexico. Chiapas: Escuintla, near Col. Zintalapa, in shaded brookside, 160 m, 23 July 1948, *Matuda 18164* (holotype, MEXU). Figure 7.

Affinis *D. biolleyi* Christ sed pinnulis basalibus tantum penitus serrato-crenatis vel minus quam ⅓ ad costulam

Figure 7. *Diplazium matudae* C. D. Adams.

Figure 8. *Diplazium moranii* C. D. Adams.

divisis; squamis ad apicem piliformibus paucis vel absentibus differt.

Rhizome unknown; scales on base of petiole 3–7 × 2–3 mm, appressed, deltate, entire, brown, clathrate, becoming retiform and lacerate; leaves 150–160 cm long, slightly dimorphic; petiole 50–65 × 0.7–0.9 cm, brownish-stramineous, pubescent with appressed septate hairs, glabrescent; blade 90–100 × 45–50 cm, 2-pinnate-pinnatifid, ovate-lanceolate, pinnatifid and long-acuminate at tip; rachis, costae and costules with few scattered, thin, ragged or twisted, hair-tipped, small, paler brown scales and numerous patent, septate, pale or brownish hairs, light brown to stramineous, scarcely darker at junction with pinnae; adaxial groove densely puberulous, with narrow membranous, brownish wings interrupted and shortly lobed at junctions; pinnae 7–30 × 1.5–9 cm, the basal slightly shorter with stalks to 7 mm, 11–14 pairs, equilateral, lanceolate to oblong-lanceolate, long-acuminate and serrate at tip; pinnules 1.5–4 × 0.7–1.5 cm, larger on sterile leaves, ca. 12–18 pairs, all sessile except 1 or 2 proximal often shorter and only narrowly adnate, lanceolate or oblong, the larger cut at base ⅓ or less into 1 or 2 pairs of prominent lobes, elsewhere crenate to serrulate, adaxially with a few erect septate hairs along costae and near bases of sinuses, abaxially with uniform erect, paler, septate hairs, firmly herbaceous, green, scarcely discolorous; veinlets to ca. 13 pairs in the larger pinnules, each branch again 1–4-forked; sori 2–8 mm, mostly diplazioid, single only distally; indusia 0.3–0.6 mm wide, subentire, without or only very rarely with short cilia, thin, hyaline or brown, folded upwards and backwards and fragmenting at maturity.

Paratype. MEXICO. GUERRERO: along Highway 125 between Pinotepa Nacional and Tlaxiaco, ca. 8.4 mi. S of Putla de Guerrero, ca. 1,000 m, 16 Jan. 1979, *Croat 45808* (fertile) (MO), *45808A* (almost all sterile) (MO).

Diplazium matudae is a medium-sized fern close to *D. biolleyi* but with the basal pinnules at most deeply serrate-crenate or divided less than one-third to the costule; hair-tipped scales few or wanting.

Diplazium moranii C. D. Adams, sp. nov. TYPE: Costa Rica. Cartago: forests near the entrance to Parque Nacional Tapantí, 1,270 m, 3 Aug. 1983, *Moran 3337* (holotype, MO). Figure 8.

Filix *D. atirrensis* (J. D. Smith) Lellinger affinis sed ad basim apicis pinnatifidi sinibus magis dilatatis (latitudine dimidium loborum contiguorum latitudinis excedentibus), pinnis lateralibus latitudine 5 cm raro attigentibus differt.

Rhizome unknown; scales (on petiole-base) to 12 × 1.5 mm, elongate-deltate, slightly twisted, yellow-brown, minutely forked-toothed along black sclerotic margins; leaf 170 cm long; petiole 60 cm long, brownish, scaly and thinly puberulous at base, becoming more densely so into rachis and costae abaxially, this mixed indumentum extending to veinlets and thinly, with minute forms of scales and hairs, to lamina; blade 110 × 36 cm, 1-pinnate-pinnatifid, oblong-lanceolate, narrowed at base, with deeply pinnatifid acuminate apex, thinly coriaceous, discolorous; adaxial midribs glabrous, without wings; free pinnae 11–17 × ca. 4 cm, 2 pairs, ovate-lanceolate, entire or subentire, with stalks 2–6 mm long; sessile pinnae 16–22 × 3–5 cm, 4 pairs, linear-lanceolate, subequilateral at narrowed cuneate base, crenate to shallowly pinnatifid with rounded lobes cut one-third to costa, shortly acuminate to an entire tip, the margin a narrow continuous band of translucent tissue; apical segments 1.5–15 × 1.5–3 cm, ca. 9 pairs, the larger linear, entire, widely spaced, slightly falcate, broadened at base to an interconnecting narrow wing; veinlets in pinnate groups, (1–)4–10-forked, strongly divergent proximally, subparallel distally, with intercostal anastomoses forming flat areoles along the winged rachis distally, otherwise generally free; sori double, continuous along all veinlets except close to lamina margin; indusium wanting.

This species is quite close to *D. atirrense*, but the sinuses at the base of the pinnatifid apex are wider, being more than half the width of the adjacent lobes, and the width of the lateral pinnae is rarely as much as 5 cm.

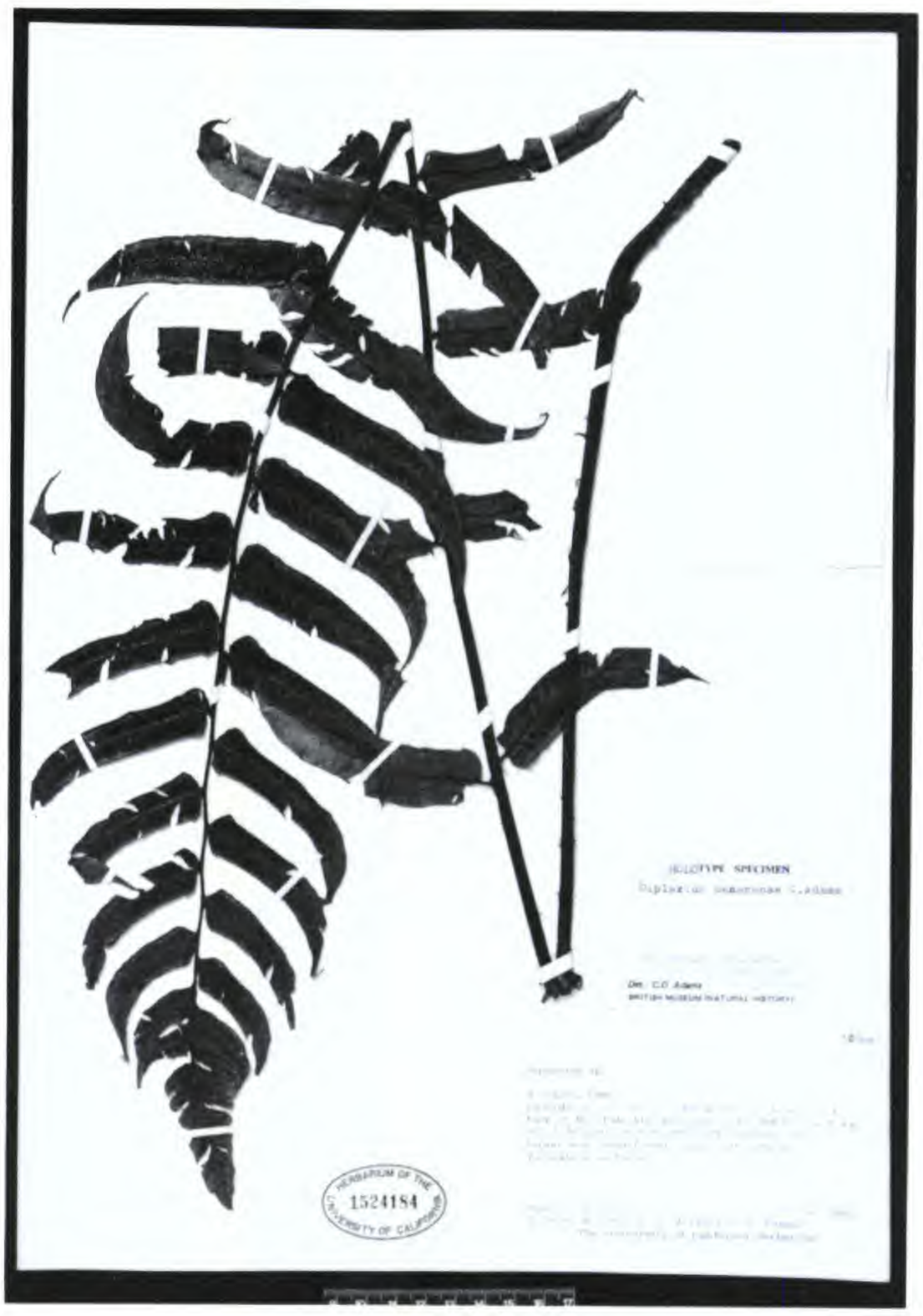

Figure 9. *Diplazium panamense* C. D. Adams.

Diplazium panamense C. D. Adams, sp. nov. TYPE: Panama. Chiriquí: along trail between N fork of Río Palo Alto and Cerro Pate Macho, ca. 6 km NE of Boquete, 8°48′N, 82°23.5′W, montane rainforest and cloud forest, 1,600–2,000 m, 6 Feb. 1986, *Smith et al. 2351* (holotype, UC). Figure 9.

Filix *D. palmensis* Rosenstock affinis sed laminae apice pinnatifido, pinnis in paria 12–14 (non 2–9) dispositis, costis venisque inferne appresso-pubescentibus differt.

Rhizome to 8 × 1.5 cm, erect; scales 6–10 × 2–2.5 mm, lanceolate, twisted, subentire, irregularly denticulate, brown, lustrous, clathrate; leaves 70–100 cm long, loosely fasciculate, dimorphic (the sterile with wider pinnae); petiole 25–37 cm long, dark brown or blackish and scaly at base, dark brown and densely puberulous with septate hairs into the rachis; blade 45–60 × 15–20 cm, 1-pinnate, ovate-lanceolate, scarcely narrowed at base, pinnatifid at apex; adaxial groove glabrescent; lateral pinnae 4–10 × 1–2.8 cm, in 12–14 alternate or subopposite pairs, 4.5–8 cm apart at base of rachis, with stalks obsolete or 2–3 mm long on fertile leaves, oblong to linear-lanceolate, subequal and truncate or subcordate-hastate at base, entire or subentire, falcate and abruptly acuminate and scarcely serrulate at tip, subcoriaceous with shortly recurved margins when dry, dark green, slightly discolorous; upper pinnae sessile or shortly adnate, without axillary buds; costae and veins abaxially with brown appressed hairs; veinlets branched from close to the costae, 2–3(–4) forked, subparallel, slightly curved close to the margin; sori 2–8 mm, irregularly diplazioid in both acroscopic and basiscopic branches; indusia ca. 0.3 mm wide, dark brown, erose, ciliate, perpendicular to the lamina at maturity.

Paratype. PANAMA. CHIRIQUI: humid forest between Alto de las Palmas and top of Cerro de la Horqueta, 2,100–2,268 m, 18 Mar. 1911, *Maxon 5520* (BM).

This species has affinity with *D. palmense* but the tip of the blade is pinnatifid rather than comprising a more or less conform terminal pinna; the lateral pinnae are more numerous; and the costae and veins are appressed-pubescent abaxially.

Figure 10. *Diplazium tutense* C. D. Adams.

Diplazium tutense C. D. Adams, sp. nov. TYPE: Panama. Veraguas: above Santa Fé beyond Escuela Agrícola Panamericana, 1.8 mi. beyond fork in road on Pacific slope above rocky ravine on side of Cerro Tute, 5 Apr. 1976, *Croat 34219* (holotype, MO). Figure 10.

Filix *D. skutchii* Lellinger affinis sed lamina axibusque utrinque glabris vel subglabris, pinnulis basalibus minus quam ⅓ ad costulam partitis, laminae textura membranacea viridique (non chartacea schistaceaque) differt.

Rhizome to 20 × 1 cm, erect; scales 10–15 × 2–4 mm, lanceolate, entire but soon lacerate and ragged and eventually fenestrated and retiform, not toothed, dark brown, very shiny, subclathrate with elongated cells, mixed with much smaller scales; leaves to 1 m or more long, compactly tufted; petiole 36 cm long, dark brown and covered with large and minute, hairlike scales at base, soon stramineous into rachis and costae, puberulous, glabrescent; blade 65 × 30 cm, 2-pinnate-pinnatifid, ovate or deltate, pinnatifid at apex to acuminate serrate tip; rachis and costae with few somewhat irregular scales with long hairlike tips, otherwise glabrous; adaxial groove shortly puberulous, the wings interrupted but scarcely lobed at junctions; pinnae 6–17 × 1.5–4.5 cm, ca. 15 pairs, stalked to 7 mm at subequal darker base, the lower slightly shorter, the upper shortly adnate at equally truncate base, linear- to oblong-lanceolate, uniformly cut to within 2–3 mm of the costa; pinnules at base of blade to ca. 2.5 × 1 cm, free from one another except by a very narrow strip of lamina tissue, rarely almost stalked and smaller in proximal positions, to 12–14 pairs, oblong, patent or antrorse, reduced toward apex of blade to ca. 5 × 5 mm, ⅓ to midvein or less, crenate-serrate laterally, dentate at tip, glabrous on both surfaces, membranaceous, green, discolorous; veinlets in larger segments 7–9 pairs, divergently 2–3-forked proximally, simple distally, remote below sinuses; sori to 4 mm, to 6–7 pairs along acroscopic veinlet-branches; indusia 0.5–0.7 mm wide, pale brown or hyaline, translucent, entire or subentire, without cilia, fragile and fragmenting at maturity.

This medium-sized fern resembles *D. skutchii*, but the blade and axes are glabrous or nearly so on both surfaces; the basal pinnules are lobed less than one-third of the way to the costule; and the lamina tissue is membranous and green rather than chartaceous and grayish.

Acknowledgments. The author, who is an honorary associate of The Natural History Museum, London, is grateful for the facilities provided and the friendly cooperation of the botanical and library staff. The curators of the following herbaria are also thanked for making their collections available for study: BM, BR, CAS, F, K, MEXU, MO, P, UC.

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Sarcoglottis caudata (Orchidaceae) and *Vellozia kolbekii* (Velloziaceae), Two New Species from Minas Gerais, Brazil

Ruy J. V. Alves
Botanical Institute, Czechoslovak Academy of Sciences, 25243 Pruhonice, near Praha, Czechoslovakia

ABSTRACT. During a vegetation survey of the São Jose mountain range in Minas Gerais, Brazil, the species *Sarcoglottis caudata* (Orchidaceae) and *Vellozia kolbekii* (Velloziaceae) were discovered; they are here described as new to science.

Sarcoglottis caudata R. J. V. Alves, sp. nov. TYPE: Brazil. Minas Gerais: Tiradentes, Serra de São Jose D'El Rei, summits of quartzite tabular mountains, 1,200 m, Oct. 1989, *R. J. V. Alves 959* (holotype, RB). Figure 1.

Planta *S. rupestri* Barb. Rodr. var. *parviflorae* Cogn. aliquanto proxima sed apice labelli caudato, sepalo intermedio ad apicem inciso, petalis basi ad sepalum intermedium connatis differt.

Geophyte, 6–8 cm tall, green herb with 1 to 3 flowers, leafless when flowering (September). Leaves unknown. Bracts linearly lanceolate, 1 cm long, 3 mm wide at base, only at base of flowers. Flowers erect, 2 cm long, externally sparsely hairy, green. Lateral sepals 10 mm long, connate to about ¼ of basal length, basally continuous with the ovary, asymmetrically linear. Dorsal sepal 9 mm long, 3 mm wide, lanceolate, caudate with incise apex, basally adnate to petals; petals 6 mm long, 1 mm wide, linearly asymmetric, apex rounded; labellum white, base widely sagittate, apex long-caudate. Labellum basally rhombic, apically caudate, 7 mm long, 3 mm wide, with undivided venation consisting of 3 main veins, 2 pairs of thinner, lateral veins that form a loop with the lamina (apically connected, Fig. 1). Column ca. 2 mm long, sulcate. Anther cap membranous. Rostellum rhombic, 1 mm long.

Habitat. Grows in white quartzitic sand deposits on slopes and summits of tabular mountains, in areas where the accumulated rainwater upwells from a shallow layer of sand lying directly on the bedrock or hardpan. The substrate is alternately wet (summer) and dry (winter).

Distribution. Known only from the São Jose D'El Rei range, Tiradentes, Minas Gerais, Brazil.

The unique labellum shape indicates that *Sarcoglottis caudata* forms a new subgroup in the genus. It is similar to *S. rupestris* var. *parviflora* in habit and habitat. Pabst & Dungs (1975, 1977) recognized 29 species of *Sarcoglottis* K. B. Presl from Brazil, of which *S. aphylla* (Ridley) Schltr., *S. cogniauxiana* (Barb. Rodr.) Schltr., *S. neuroptera* (Reichb. f. & Warming) Schltr. and *S. rupestris* Barb. Rodr. are from Minas Gerais. Somewhat earlier, Hoehne (1945) stated that the above species are so closely allied that they should be joined into one. According to the present data, *S. caudata* is known only from the São Jose range, while the type of *S. rupestris* var. *parviflora* was found in the vicinity of São João D'El Rei.

More new species of *Sarcoglottis* can be expected from the isolated campo rupestre ranges of Minas Gerais. Most of the described species are endemic to small ranges, and some are only known from type collections.

Vellozia kolbekii R. J. V. Alves, sp. nov. TYPE: Brazil. Minas Gerais: Tiradentes, Serra de São Jose D'El Rei, 1,200 m, 22 Oct. 1989, *R. J. V. Alves 852* (holotype, SPF; phototype, NHB). Figures 2, 3.

Velloziae brachypodae Lyman B. Smith & Ayensu proxima sed caudice multo longiore, tepalis longioribus, ovario obscure trigonaliter que tereti, staminibus paucioribus, foliis capsulaque glabris differt.

Heliophyllous phanerophyte. Caudex sparingly branched, usually 150 cm tall (rarely over 300 cm), erect, 5–15 cm diam. including the golden-yellow, persistent leaf sheaths. Leaves ca. 8 to 10 produced in each season, ca. 12 live and 65 dry in each rosette, 33 cm long (without the sheaths), base 14 mm wide, blades parchmentlike, narrowly triangular, attenuate, glabrous except for the finely setose-serrulate margins; venation of lamina consists of median vein with 27 congruent secondary veins on either side; scapes subterminal, 3–8 per rosette, pedicel ca. 9 cm long, 3 mm diam., cylindric, curved so that the flowers are naturally in horizontal position, reaching about ¼ length of the leaves, glabrous at the base, slightly verrucose under the ovary (i.e., subapically). Ovary smooth, glabrous, in fresh flowers 7 mm diam., 12 mm long, cylindric to fusiform;

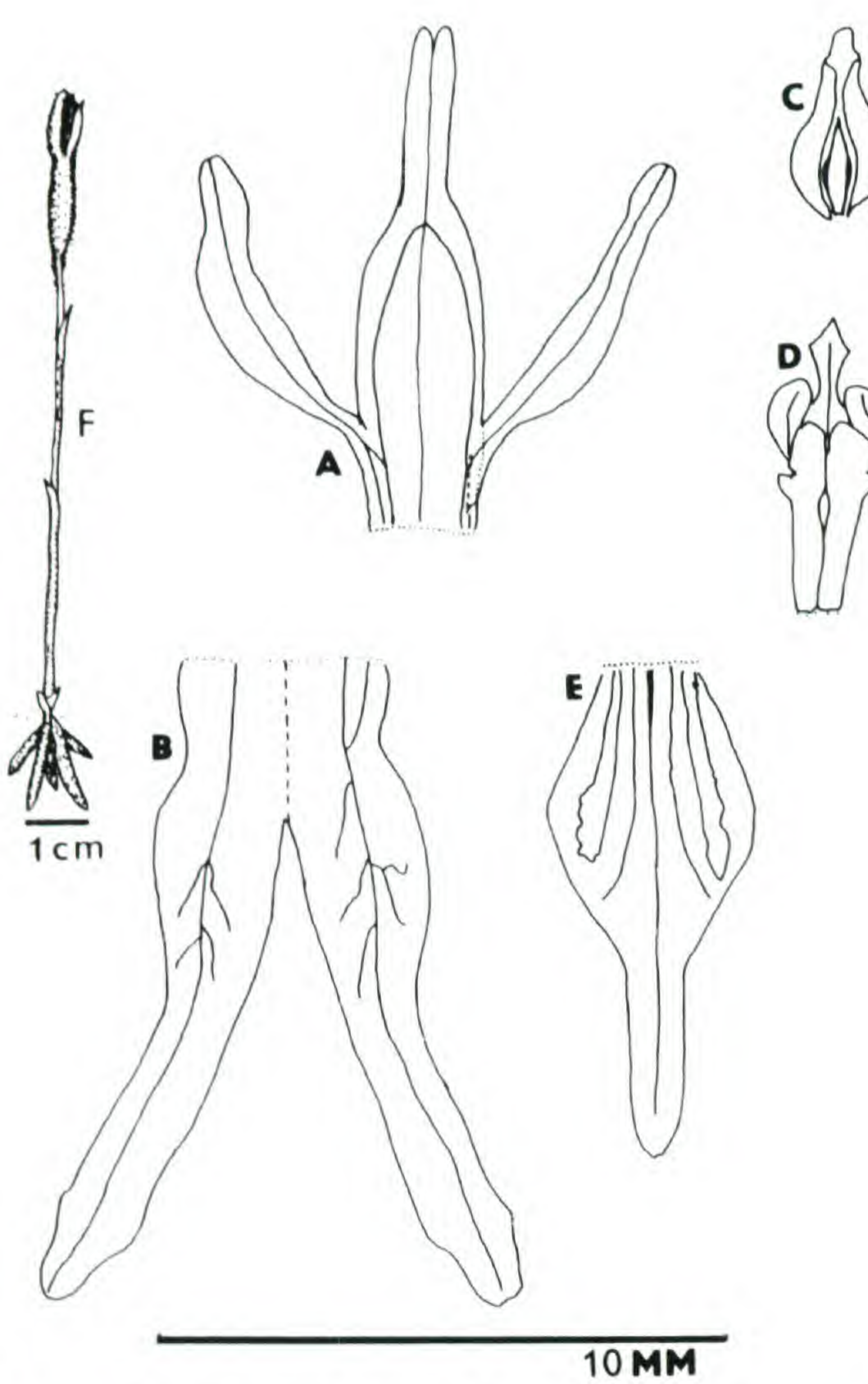

Figure 1. *Sarcoglottis caudata* R. J. V. Alves. —A. Dorsal sepal with attached petals. —B. Fused lateral sepals. —C. Anther cap. —D. Column with rostellum. —E. Labellum. —F. Habit.

capsule terete, bluntly trigonal with slightly sulcate facets when green, apically constricted with a broad crown and smooth when dry. Perigonium deep light purple, anthers and stigma sulphury yellow, ovary greenish to magenta, live parts covered with sticky substance. Only flowering specimen seen. Epigynous tube subcylindric, 4 mm high; tepals free except for a slight basal connation (1 to 2 mm), violet-blue, basally grading to white, 4 cm long, tepals of the inner whorl obovate-lanceolate with slightly constricted apex, 3 main undivided and 8 lateral veins; outer tepals broader, widely lanceolate, apical apicule less pronounced, 3 central and 5 lateral veins; stamens in groups of 5 to 6, bases of filaments connate in these groups, on base of tepals; stamens in observed specimen 32, slightly less than ½ the length of the tepals; anthers linear-cylindric, 1 mm diam., 19 mm long; filaments 10 mm long, less than ½ diam. of anthers, white; style 24 mm long, 1 mm diam., stigma 3-lobed, lobes suborbicular to reniform. Dorsiventral transverse section of lamina (data from boiled herbarium specimen): no hairs observed,

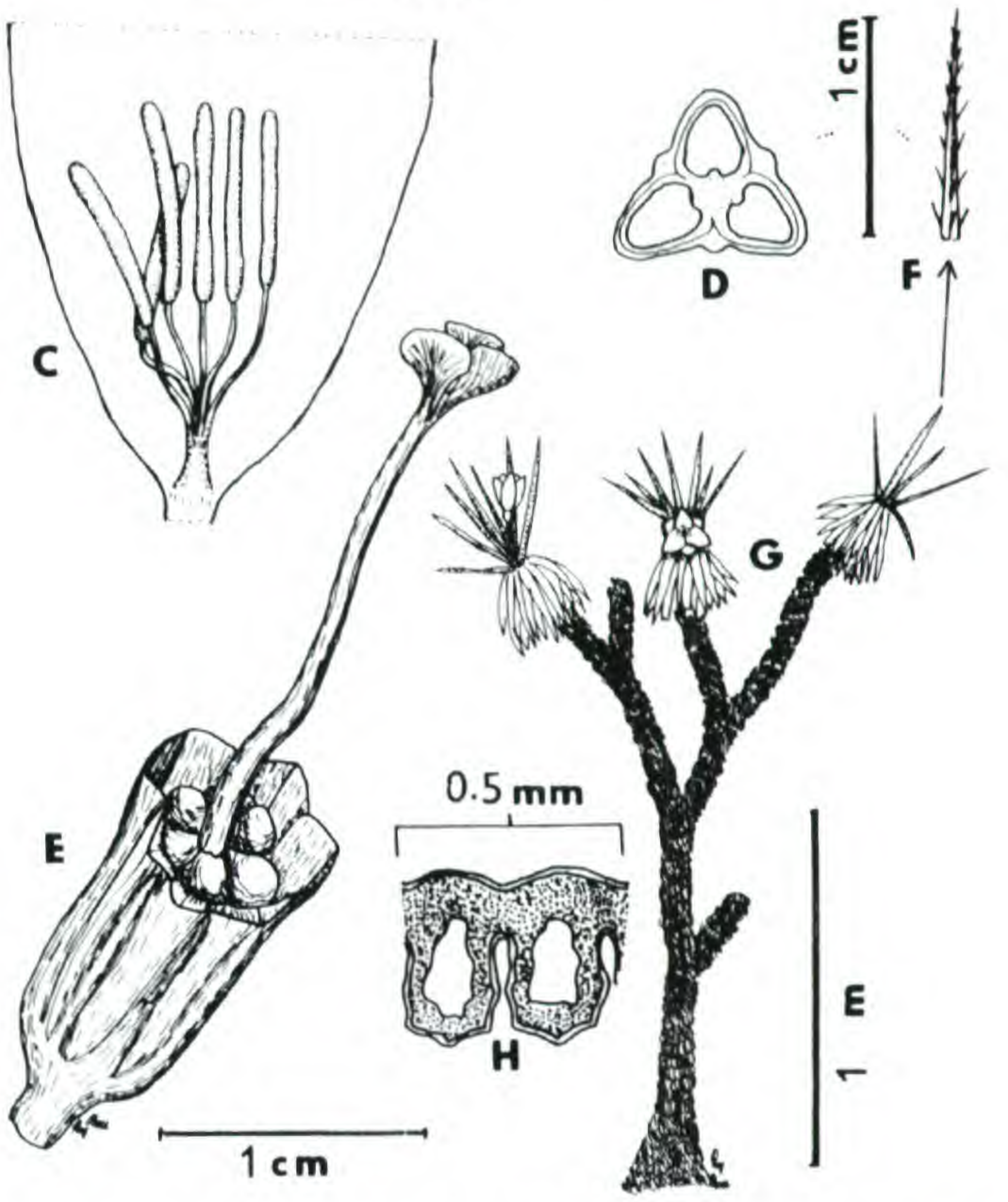

Figure 2. *Vellozia kolbekii* R. J. V. Alves. —A. Tepal of inner whorl. —B. Tepal of outer whorl. —C. Insertion of stamens. —D. Transversal section of ovary. —E. Ovary with style. —F. Leaf apex with marginal setae. —G. Habit. —H. Transverse section of lamina.

adaxial surface smooth and slightly undulate; abaxial surface furrowed to ¾ of blade (Fig. 2H).

Habitat. On exposed quartzite outcrops and scree with little or no soil, sometimes forming closed thickets.

Dedicated to Jiri Kolbek, who took part in the field research.

Distribution. Presently known only from the São Jose D'El Rei range near Tiradentes, Minas Gerais, Brazil.

Vellozia kolbekii was confirmed as new by Lyman B. Smith (pers. comm.). It differs from *V.*

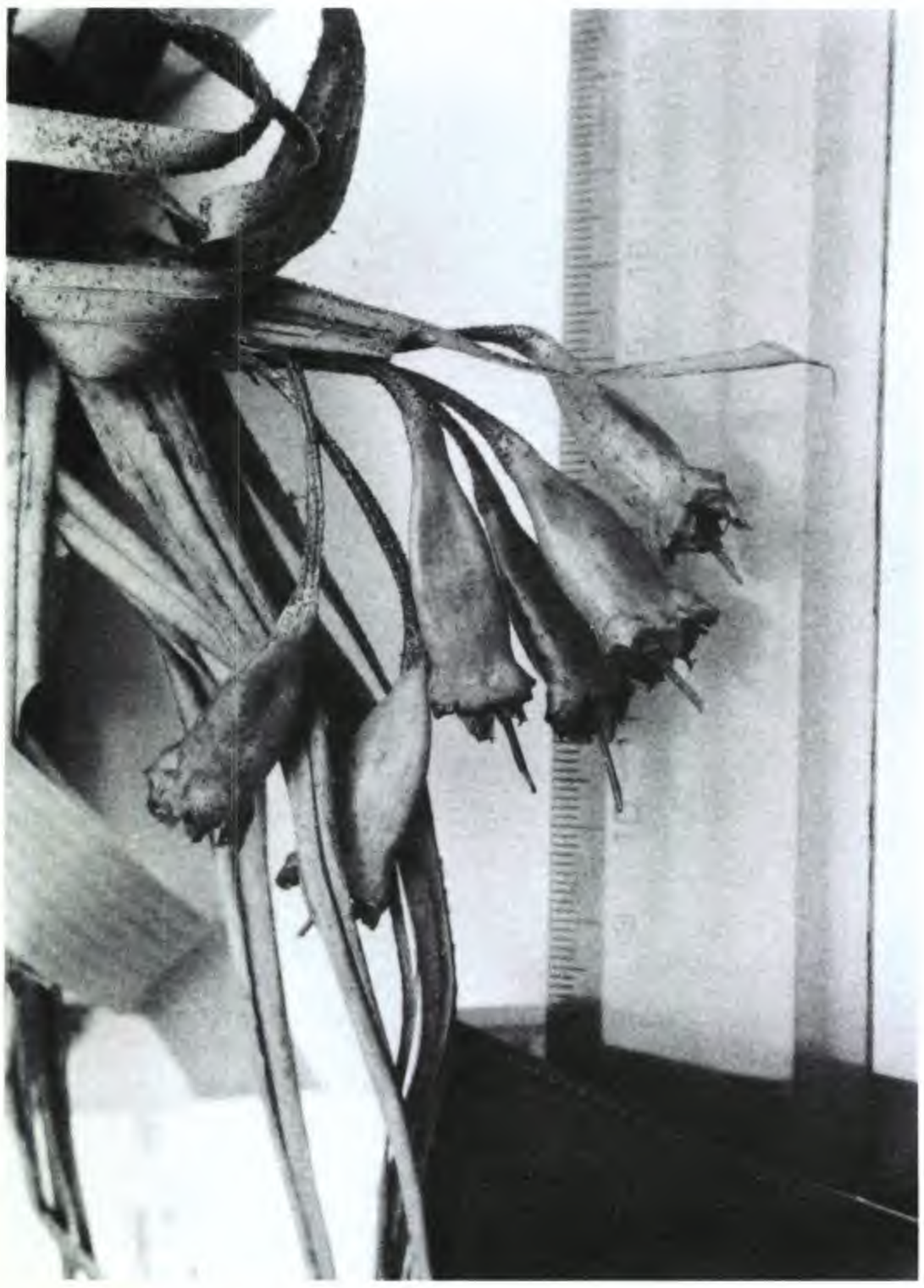

Figure 3. *Vellozia kolbekii* R. J. V. Alves. Holotype, detail of scapes and capsules.

brachypoda mainly by a longer caudex, longer tepals, a more angular ovary with the apex broadened into a crown (Fig. 3), leaves with more linear setae on margins, and deeper furrows on the abaxial surface. It further differs from *V. variabilis* Martius ex Schultes f. by a glabrous ovary, from *V. tomeana* Lyman B. Smith & Ayensu by partly connivent staminal filaments, a glabrous ovary and glabrous leaves. The fact that *V. kolbekii* has a glabrous ovary and that part of its scape is slightly vestite may indicate a possible relationship with *V. subscabra* Mikan (*V. scabra* Sprengel), listed under "Excluded and Doubtful Taxa" by Smith & Ayensu (1976); however, genus *Vellozia* Vand. needs to be studied further before this can be proved. In the diagnosis of *V. tomeana*, Smith & Ayensu (1976: 82) declared the leaves glabrous, and subsequently discriminated large hair tufts on both surfaces.

Additional habitat observations. Both newly described species were discovered in the São Jose mountain range north of Tiradentes, Minas Gerais, Brazil. This range rises from 900 to 1,430 m, being situated between 21°03–07′S and 44°06–13′W. It consists of quartzite outcrops with irregularly eroded surfaces, and sand deposits originated by erosion of this bedrock. Both substrates bear sparse stands of herbaceous vegetation with an open shrub layer. The local climate consists of cool, dry winters and hot, rainy summers that culminate in January. Absolute temperatures range from 1.0° to 36.2°C and mean values of 9.9° (July) to 25.9° (January). Annual precipitation averages to 1,467 mm (8.6 mm in July, 299.6 mm in January). *Vellozia kolbekii* grows on quartzite outcrops, forming dense stands, while *Sarcoglottis caudata* is restricted to the sand deposits on summits and in lower-situated valleys, where it thrives in moist spots that are flooded for many days after each rainstorm.

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Two New Species of *Stigmaphyllon* (Malpighiaceae) from Peru

Christiane Anderson
University of Michigan Herbarium, North University Building, Ann Arbor, Michigan 48109-1057, U.S.A.

ABSTRACT. Two new species of the neotropical wing-fruited genus *Stigmaphyllon* (Malpighiaceae) are described from Peru, *S. argenteum* from the eastern lowlands and *S. cuzcanum* from the uplands of Cuzco.

Stigmaphyllon, one of the wing-fruited genera of the Malpighiaceae, comprises nearly 100 species, which occur from southern Mexico and the Caribbean to northern Argentina, except in Chile. Most species have large, cordate, long-petioled leaves and umbels or pseudoracemes of yellow flowers disposed in dichasially branched inflorescences. The androecium of 10 stamens is most often heterogeneous; the stamens opposite the lateral sepals usually bear modified anthers consisting of an enlarged connective bearing 0–2 reduced locules. Each of the three styles is commonly ornamented with an apical appendage, the foliole, for which the genus is named. Typically, the samara bears a large, flared dorsal wing, and the nut is often ornamented with lateral winglets and/or spurs and crests.

Two new species are here described so that the names will be available for inclusion in the forthcoming *Catalogue of the Flowering Plants and Gymnosperms of Peru* (Brako & Zarucchi, in prep.). With the addition of these novelties, 18 species of *Stigmaphyllon* are now reported from Peru.

Stigmaphyllon argenteum C. Anderson, sp. nov.
TYPE: Peru. Huánuco: Prov. Pachitea, Dtto. Honoria, Bosque Nacional de Iparia, a lo largo del Río Pachitea cerca del campamento Miel de Abejas, 1 km arriba del pueblo Tournavista o unos 20 km arriba de la confluencia con el Río Ucayali, 300–400 m, 30 May 1967, *Schunke V. 2018* (holotype, NY; isotypes, COL, F, G, US). Figure 1.

Liana. Laminae 2.5–15.3 cm longae, 5.7–14 cm latae, triangulares, ovatae, ellipticae vel suborbiculares vel interdum 3–5-lobatae, supra glabrae vel interdum sparsim sericeae, subtus sericeae, margine sparsim glanduloso. Inflorescentia dichasialis constata ex umbellis, floribus in quaque umbella ca. 15–30. Pedunculi 3–7.5 mm longi; pedicelli 4–8.5 mm longi. Petala lateralia limbo orbiculari vel late obovato, margine eroso; petalum posticum limbo elliptico vel late obovato, margine eroso vel fimbriato-denticulato. Stamina heteromorpha, antheris glabris; antherae sepalis antico-lateralibus oppositae 1–2 loculis reductis instructae, antherae sepalis postico-lateralibus oppositae 1 loculo reducto instructae. Stylus anticus ca. 2.2 mm longus, glaber, utroque foliolo ca. 1.4 mm longo, ca. 1.2 mm lato, subquadrato; styli postici 2.6–3 mm longi, glabri, lyrati, foliolo ca. 1.4–2 mm longo latoque, subquadrato. Samara ala dorsali ca. 4.5 cm longa, 1.4–11.7 cm lata; alulae laterales absentes; nux 4–5.5 mm alta, 3.5–4.5 mm diametro.

Vine to 14 m. Laminas 2.5–15.3 cm long, 5.7–14 cm wide, triangular, ovate, or elliptical to suborbicular, or sometimes 3–5-lobed, apex acuminate, base truncate to cordate, sometimes sparsely sericeous but usually glabrous above, sericeous below (trabecula 0.2–0.5 mm long, straight, sessile), margin shallowly crenate to subentire and with irregularly spaced sessile glands (0.5–0.6 mm diam.) in the sinuses and with filiform glands (up to 1.5 mm long), with a pair of prominent but sessile glands at the apex of the petiole, each gland 1.5–3.5 mm diam.; petioles 2–10+ cm long, sericeous; stipules 0.7–1.2 mm long and wide, triangular, eglandular. Flowers ca. 15–30 per umbel, these borne in dichasia or compound dichasia. Peduncles 3–7.5 mm long, pedicels 4–8.5 mm long; peduncles 0.6–1.2 times as long as the pedicels. Bracts 0.9–1.3 mm long, 0.6–1 mm wide, narrowly triangular; bracteoles 0.7–1.2 mm long, 0.6–1 mm wide, triangular, eglandular. Sepals 1.8–2.3 mm long, 1.5–2 mm wide, glands 1.6–2.3 mm long, 0.6–1.2 mm wide. All petals glabrous, yellow; lateral petals with the limbs orbicular or broadly obovate, margin erose; anterior-lateral petals: claw 1.8–2.2 mm long, limb ca. 7 mm long and wide; posterior-lateral petals: claw 0.5–1 mm long, limb 6–6.7 mm long, 4.5–6 mm wide; posterior petal: claw 2.5–2.8 mm long, apex strongly indented, limb 5–5.6 mm long, 3.5–4.8 mm wide, elliptical or broadly obovate, margin erose to fimbriate-denticulate, teeth/fimbriae up to 0.5 mm long. Stamens unequal, those opposite the posterior styles the largest; anthers all loculate, glabrous, those of stamens opposite the anterior-lateral sepals with 1 or 2 locules, those of stamens opposite the posterior-lateral sepals with only 1 locule. Anterior style ca. 2.2 mm long, shorter than the posterior two, glabrous; each foliole ca. 1.4 mm long,

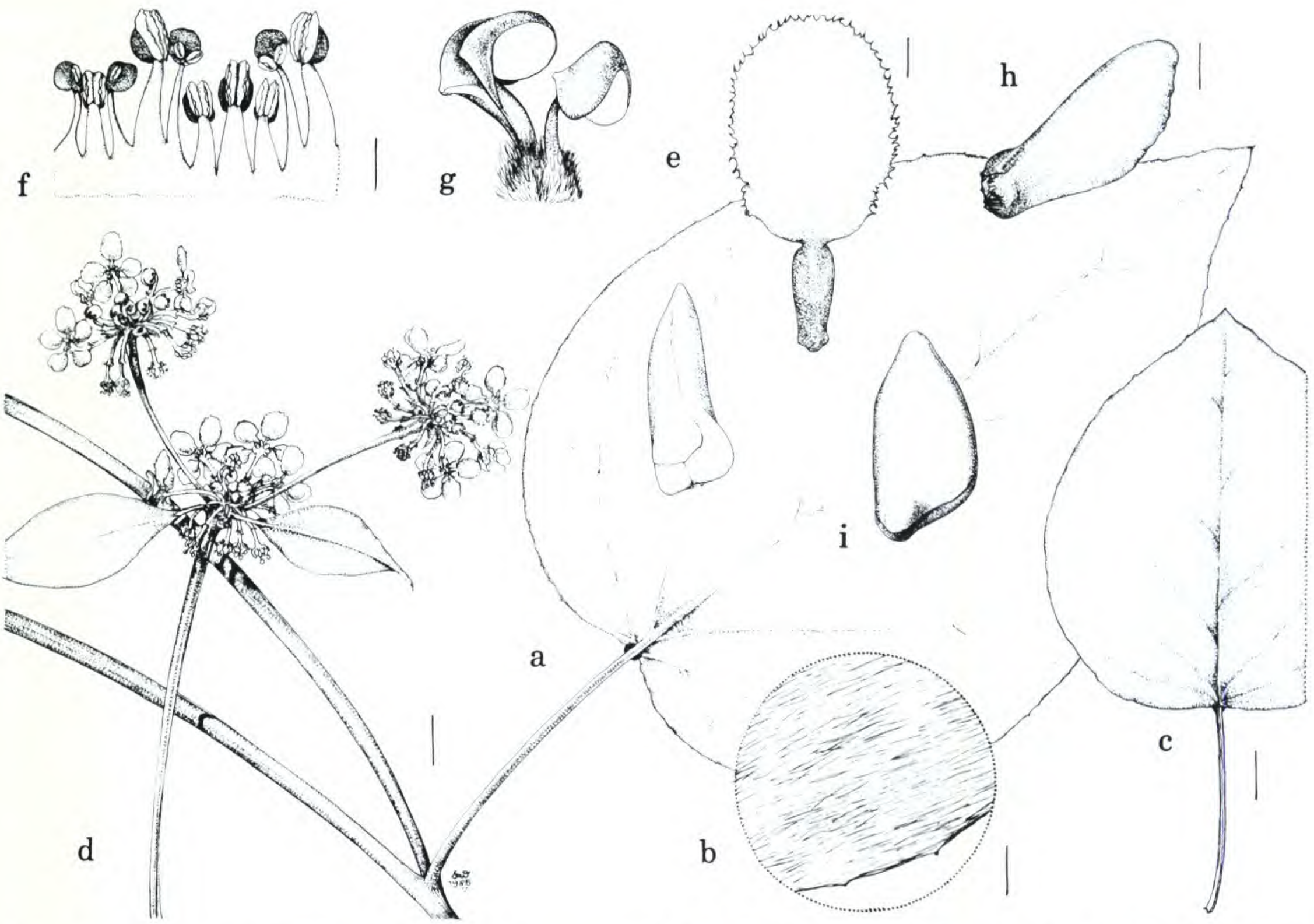

Figure 1. *Stigmaphyllon argenteum* C. Anderson. —a. Portion of branch with large leaf. —b. Detail of abaxial surface of lamina. —c. Small leaf. —d. Flowering branch. —e. Posterior petal. —f. Androecium; second stamen from left opposes posterior petal. —g. Gynoecium, anterior style to the right. —h. Samara. —i. Two views of an embryo. Scale for a, c, d, h, bar = 1 cm; for b, bar = 0.5 mm; for e–g, bar = 1 mm. Based on: a, b, d–g, *Schunke V. 2018;* c, h, i, *Croat 19640.*

ca. 1.2 mm wide, subsquare. Posterior styles 2.6–3 mm long, glabrous, lyrate; foliole ca. 1.4–2 mm long and wide, subsquare. Dorsal wing of samara ca. 4.5 cm long, 1.4–1.7 cm wide, lateral winglets absent, nut only prominently ribbed; nut 4–5.5 mm high, 3.5–4.5 mm diam., areole 3–3.5 mm long, 2.5–2.8 mm wide, concave, carpophore up to 1.8 mm long. Embryo 5.8–7.3 mm long, ca. 2 times as long as wide, ovoid, outer cotyledon 6.1–8.3 mm long, 2.6–3.9 mm wide, the distal ⅓ folded over the inner cotyledon, inner cotyledon 4–6.6 mm long, 2–3.6 mm wide, straight or the tip folded back on itself.

Phenology. Collected in flower from April through July, in fruit in May and from July through September.

Distribution. Lowlands of eastern Peru; in forests and thickets and at roadsides; 135–670 m.

Paratypes. PERU. HUANUCO: Prov. Pachitea, region of Pucallpa, ca. 26 km S to 24 km SSE of Puerto Inca, N of Río Yuyapichis, 09°34–37′S, 74°53–56′W, *Wallnöfer 11-31588* (MICH); vicinity of Tingo María, 3–5 km from Huánuco–Tingo María rd. on Monzón rd., *Mathias & Taylor 3647* (F, UCLA). JUNIN: Puerto Bermudez, *Killip & Smith 26630* (F, NY, US); Prov. Satipo, E bank of Río Ene at mouth of Río Quipachiari, *Madison 10427-70* (F). LORETO: Quebrada Shanuce above Yurimaguas, *Croat 17999* (MICH); Isla de Ushpa-cano near mouth of Río Itaya, *Croat 19640* (MICH); Ucayali, Bosque Nacional Alexander von Humboldt, between Km 90–130 of Pucallpa–Tingo María rd., 08°48′S, 75°20′W, *Gentry et al. 41413* (MO); wooded banks on lower Río Huallaga, *Killip & Smith 29004* (F, GH, NY); Prov. Maynas, vicinity of Iquitos, Río Momón, quebrada Momoncillo, *McKenna et al. DMK-91* (AMAZ, F, MICH, MO). PASCO: Oxapampa, ca. 5 km up Río Iscozacín from village of Iscozacín, 10°12′S, 75°13′W, *Knapp & Staver 7802A* (MICH); Palcazu Valley, Río San José in the Río Chuchurras drainage, 10°09′S, 75°20′W, *D. Smith 4002* (MICH). SAN MARTIN: between Tocache Nuevo and Juanjui, 18.7 km S of Río Pulcache, 07°55′S, 76°40′W, *Croat 58052* (MICH); vicinity of Aguaytía, Boquerón de Padre Abad, *Mathias & Taylor 3591, 6092* (F, UCLA); Prov. Mariscal Cáceres, Dtto. Tocache Nuevo, quebrada de Santiago, al E de Puerto Pizana, *Schunke V. 6530* (GH, MO); Prov. Mariscal Cáceres, Dtto. Tocache Nuevo, quebrada de Cachiyaca, afluente de la quebrada de Huaquista, al E de Puerto Pizana, *Schunke V. 8528* (F, MICH, MO).

Stigmaphyllon argenteum is named for the silvery, sericeous pubescence on the abaxial leaf sur-

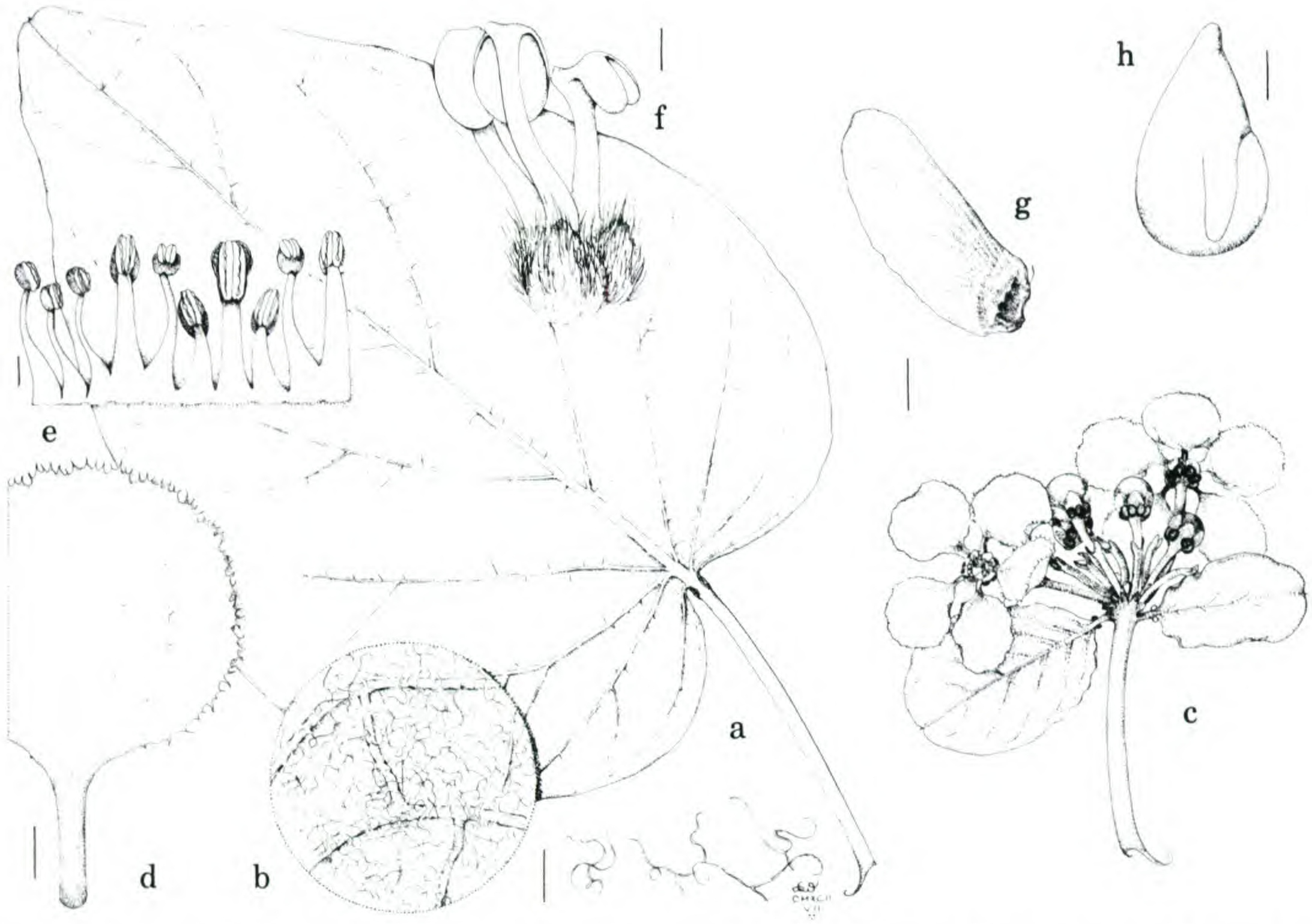

Figure 2. *Stigmaphyllon cuzcanum* C. Anderson. —a. Large leaf. —b. Detail of abaxial surface of lamina and individual hairs. —c. Umbel. —d. Posterior petal. —e. Androecium; second stamen from left opposes posterior petal. —f. Gynoecium, anterior style to the right. —g. Samara. —h. Embryo. Scale for a, c, g, bar = 1 cm; for b (detail) bar = 0.5 mm, b (hairs) bar = 0.3 mm; for d, h, bar = 2 mm; for e, f, bar = 1 mm. Based on: a, b, d, *West 6466;* c, e, f, *Stafford 9*; g, *Tutin 1310;* h, *Núñez V. & Motocanchi 8751.*

faces. It is characterized by its small petals, the limbs only up to 7 mm in diameter, the uniloculate anthers of stamens opposite the posterior-lateral sepals, and its samaras, which lack lateral wings. Collections of this species have been assigned most commonly to the widespread and variable *S. sinuatum* (DC.) Adr. Juss., though labeled with one of its many synonyms (*S. fulgens*, *S. hypoleucum*, *S. martianum*, *S. splendens;* see Anderson, in press). In *S. sinuatum*, the flowers are aggregated into pseudoracemes instead of umbels, the petals are up to 14 mm in diameter, the stamens opposite the posterior-lateral sepals have unmodified biloculate anthers, the styles are commonly pubescent (glabrous in *S. argenteum*), and the nut of the samara usually bears lateral winglets. *Stigmaphyllon argenteum* is rarely mistaken for one of the three other sympatric species with abaxially sericeous leaves, *S. maynense* Huber, *S. puberum* (Rich.) Adr. Juss., and *S. cardiophyllum* Adr. Juss. *Stigmaphyllon maynense* and *S. puberum* differ from most species of the genus in that the anterior style and its opposing stamen are much larger than the posterior styles and their opposing stamens. The nut of the samara of *S. maynense* bears 3–4 lateral winglets per side, whereas the unique samara of *S. puberum* is distinguished by an erect dorsal wing, tapered from the base, and lacks a carpophore. *Stigmaphyllon cardiophyllum* is easily separated by its usually glabrate to glabrous leaves, though sometimes very sparsely sericeous below, and its abundantly pubescent anthers. The remaining sympatric species differ in that the leaves are beset with T-shaped hairs below.

Stigmaphyllon cuzcanum C. Anderson, sp. nov. TYPE: Peru. Cuzco: below Machu Picchu, 2,100 m, *West 6466* (holotype, MO). Figure 2.

Liana. Laminae 7–19 cm longae, 5.5–12.7 cm latae, ovatae, supra glabrae, subtus tomentosae, margine eglanduloso vel sparsim glanduloso. Inflorescentia solitaria vel dichasialis constata ex umbellis, floribus in quaque umbella ca. 10–35. Pedunculi 3.5–15.5 mm longi; pedicelli 7–13.5 mm longi. Petala limbo orbiculari, margine fimbriato vel fimbriato-denticulato. Stamina heteromorpha, antheris glabris vel raro pubescentibus; antherae sepalis lateralibus oppositae 2 loculis reductis instructae. Stylus anticus 4.2–5.1 mm longus, glaber, utroque foliolo ca. 1.4–1.8 mm longo, 1–1.5 mm lato, elliptico; styli postici 5–6 mm

longi, glabri vel basi sparsim pubescentes, lyrati, foliolo 2–2.5 mm longo, ca. 1.8 mm lato, subrectangulari. Samara ala dorsali 3.8–4.5 cm longa, ca. 2 cm lata; nux ca. 10 mm alta, ca. 5.5 mm diametro, alulis lateralibus instructa.

Vine. Laminas 7–19 cm long, 5.5–12.7 cm wide, ovate, apex emarginate-mucronate, base cordate to deeply so in larger leaves and to truncate in smaller ones, glabrous above, tomentose below (trabecula 0.9–1.5 mm long, crisped and curled, stalk 0.1–0.3 mm long), margin eglandular or with irregularly spaced sessile glands (0.3–0.4 mm diam.), with a pair of prominent but sessile glands at the apex of the petiole, each gland 1.8–2.5 mm diam.; petioles 3–7.3 cm long, densely sericeous to glabrous in older leaves; stipules 1–1.5 mm long, 0.8–1.3 mm wide, triangular, eglandular. Flowers ca. 10–35 per umbel, these borne solitary or in dichasia or in small thyrses. Peduncles 3.5–15.5 mm long, pedicels 7–13.5 mm long; peduncles 0.6–1.4 times as long as the pedicels. Bracts 1.2–2.5 mm long, 0.8–1.3 mm wide, triangular; bracteoles 1.1–2.3 mm long, 0.7–1.4 mm wide, narrowly triangular, eglandular or each bracteole with a pair of glands (each 0.4–0.5 mm diam.). Sepals 2.5–3.5 mm long, 2.5–3.2 mm wide, glands 2–2.5 mm long, 1–1.3 mm wide. All petals glabrous, yellow, with the limbs orbicular, margin fimbriate or denticulate-fimbriate, fimbriae/teeth up to 0.5 mm long; anterior-lateral petals: claw ca. 3–4 mm long, limb ca. 16–18 mm long and wide; posterior-lateral petals: claw ca. 2.5–3 mm long, limb ca. 15 mm long and wide; posterior petal: claw 3.5–4.5 mm long, apex not or only very slightly indented, limb ca. 14 mm long and wide, margin at the base sometimes with a stalked gland (ca. 0.4 mm long). Stamens unequal, those opposite the posterior styles with the longest filaments, anthers of those opposite the anterior-lateral sepals with the connective enlarged and the locules reduced; anthers all loculate, glabrous or rarely sparsely pubescent. Anterior style 4.2–5.1 mm long, shorter than the posterior two, glabrous; each foliole 1.4–1.8 mm long, 1–1.5 mm wide, elliptical. Posterior styles 5–6 mm long, glabrous or with a few scattered hairs in the basal ⅓, lyrate; foliole 2–2.5 mm long, ca. 1.8 mm wide, subrectangular. Dorsal wing of samara 3.8–4.5 cm long, ca. 2 cm wide, nut bearing 1–2 grossly dentate rectangular lateral winglets per side, these 3.5–8 mm long, up to 2.5 mm wide, and also spurs; nut ca. 10 mm high, ca. 5.5 mm diam., areole ca. 4 mm long, ca. 3.5 mm wide, concave, carpophore up to 5 mm long. Embryo 8.5 mm long, ca. 2 times as long as wide, ovoid, outer cotyledon ca. 13 mm long, ca. 4.2 mm wide, the distal ⅓ folded over the inner cotyledon, inner cotyledon ca. 7.3 mm long, ca. 3.3 mm wide, straight.

Phenology. Collected in flower in February, May, June, and August, in fruit in January, February, June, and August.

Distribution. Peru, Depto. Cuzco, Prov. La Convención; in brush forests and clearings; 1,800–2,700 m.

Paratypes. PERU. CUZCO: San Miguel, Urubamba Valley, *Cook & Gilbert 939* (NY, US); Prov. La Convención, 139 km de Cuzco en Quillomayo, entre Santa Teresa y Chaullay, 13°08′S, 72°36′W, *Núñez V. & Motocanchi 8751* (MICH); Machu Picchu, *Stafford 9* (K); Machu Picchu, Urubamba Valley, *Tutin 1310, 1328* (BM); Prov. La Convención, Machu Picchu, *Vargas C. 814* (F); Prov. La Convención, *Weberbauer 4989* (G).

Stigmaphyllon cuzcanum is notable for its large, abaxially tomentose leaves and its large flowers, borne in umbels that are aggregated into thyrses. The petals are among the largest in the genus; the limb of the anterior-lateral petal is 16–18 mm in diameter. The stamens opposing the posterior-lateral sepals are not modified, as in most other species. The nut of the samara bears 1–2 grossly dentate rectangular lateral winglets per side. This species is readily separated from the two other species of *Stigmaphyllon* reported from Cuzco. In *S. cardiophyllum*, the leaves are abaxially glabrate to glabrous or sometimes sparsely sericeous, the flowers are very small (the limbs of the petals only up to 6.5 mm in diameter), and the samaras lack lateral winglets. *Stigmaphyllon strigosum* Adr. Juss. differs in its smaller long-fimbriate petals streaked with red (limbs up to 14 mm in diameter, fimbriae up to 0.9 mm long), modified anthers of stamens opposing the posterior-lateral sepals (the connective enlarged and the locules reduced), and samaras with 3 to 4 lateral winglets per side.

Acknowledgments. I thank William R. Anderson for his comments. Karin Douthit drew the illustrations. I am grateful to the curators of the following herbaria for making their collections of *Stigmaphyllon* available to me: AMAZ, BM, COL, F, G, GH, K, MICH, MO, NY, UCLA, US.

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Change in Status of *Pinus cembroides* Subsp. *orizabensis* (Pinaceae) from Central Mexico

D. K. Bailey
University of Colorado Museum, Boulder, Colorado 80302, U.S.A.

Frank G. Hawksworth
USDA Forest Service, Rocky Mountain Forest and Range Experiment Station, Fort Collins, Colorado 80526, U.S.A.

ABSTRACT. The Orizaba pinyon (*Pinus cembroides* subsp. *orizabensis*) is raised to specific status. *Pinus orizabensis* differs from *P. cembroides* in many characters, including needle and bark morphology and terpene chemistry.

Orizaba pinyon, *Pinus cembroides* Zucc. subsp. *orizabensis* D. K. Bailey, is a local taxon of east central Mexico described by Bailey (1983). The taxon is here raised to specific rank because of marked differences in needle and bark morphology and terpene chemistry between it and *P. cembroides*.

Pinus orizabensis (D. K. Bailey) D. K. Bailey & Hawksworth, comb. et stat. nov. Basionym: *Pinus cembroides* Zucc. subsp. *orizabensis* D. K. Bailey, Phytologia 54: 89. 1983. TYPE: Mexico. Puebla: Mpio. Soltepec, ca. 10 km SW of San Salvador el Seco on Highway 140, 19°04′N, 97°42′W, 2,370 m, 1983, *D. K. Bailey 83-01* (holotype, MEXU; isotypes, ARIZ, CHAPA, COLO, E, ENCB, INIF, K, MO, NY, RM, TEX, UC, US, UTC).

Pinus cembroides, as interpreted by Bailey (1983) and Bailey & Hawksworth (1988), was considered to be comprised of three allopatric subspecies:

1. Subspecies *cembroides*, the most widespread taxon, ranging from northern Chihuahua and west Texas throughout the Sierra Madre Occidental and Sierra Madre Oriental to central Mexico (Hidalgo and northern Veracruz).

2. Subspecies *lagunae* (Robert-Passini) D. K. Bailey, a local endemic restricted to the Sierra Laguna in southern Baja California.

3. Subspecies *orizabensis* D. K. Bailey, a local endemic in Puebla, Tlaxcala, and Veracruz.

Since that time there has been a trend to accept subspecies *lagunae* as a distinct species, *Pinus lagunae* M.-F. Passini (1987), e.g., in the recent compendium of the pines of Mexico and Central America (Perry, 1991). However, because the differences between subspecies *cembroides* and *orizabensis* are greater than those between subspecies *cembroides* and *lagunae*, we suggest raising subspecies *orizabensis* to species rank as well.

Pinus orizabensis and *P. cembroides* are not sympatric, and the gap between them is about 140 km (Bailey, 1983). The two pines differ in several morphological, chemical, and ecological features (Bailey, 1983), some of which are listed in Table 1.

Acknowledgment. We thank Teobaldo Eguiluz Piedra, Director, Centro de Genética Forestal, Chapingo, Mexico, for encouraging us to make this new combination.

TABLE 1. Comparisons of some characters of *Pinus orizabensis* and *P. cembroides*.

Character	*P. orizabensis*	*P. cembroides*
Needle number per fascicle	Range 2–5; ca. 75–95% in 3's, 5–20% in 4's	Range 2–4; ca. 60% in 2's and 40% in 3's
Needle color	Dorsal surface bluish-green; ventral surface markedly glaucous	Dorsal surface yellow-green; ventral surface slightly glaucous
Bark of mature trees	Thin, little transverse fissuring, inner bark conspicuous, orange	Thick, strong transverse fissuring, inner bark inconspicuous, yellow
Monoterpenes	3-carene usually less than 1%	3-carene usually ca. 10%
Main elevational range	2,300–2,700 m	1,700–2,400 m

Literature Cited

Bailey, D. K. 1983. A new allopatric segregate from and a new combination in *Pinus cembroides* Zucc. at its southern limits. Phytologia 54: 89–100.

——— & F. G. Hawksworth. 1988. Phytogeography and taxonomy of the pinyon pines, *Pinus* subsection *Cembroides*. Pp. 41–64 *in* II Simposio Nacional sobre Pinos Pinoneros, Centre d'Etudes Mexicaines et Centroaméricaines, Mexico City, Mexico.

Passini, M.-F. 1987. The endemic pinyon of Lower California. *Pinus lagunae* M.-F. Passini. Phytologia 63: 337–338.

Perry, J. 1991. The Pines of Mexico and Central America. Timber Press, Portland, Oregon.

Platanthera pallida (Orchidaceae), a New Species of Fringed Orchis from Long Island, New York, U.S.A.

Paul Martin Brown

15 Dresden Street, Jamaica Plain, Massachusetts 02130-4407, U.S.A.

ABSTRACT. Reexamination of the species and hybrids of the simple-lipped group of the genus *Platanthera* sect. *Blephariglottis* shows that several colonies found on eastern Long Island constitute a new species. *Platanthera pallida* is described based upon its recurved lip, reflexed lateral sepals, pale cream coloration, and unusual habitat—dry, interdunal hollows. It was previously referred to as *P. cristata* because of its superficial resemblance to that species and lack of other similar fringed orchises in the northeastern United States.

Platanthera pallida P. M. Brown, sp. nov. TYPE: United States. New York: Long Island, Suffolk County, Montauk, *C. S. Bryan*, 10 Aug. 1948 (holotype, AMES 65176). Figure 1.

Platantherae cristatae (Michaux) Lindley similis, sed ab ea perianthio in alabastro perpallide aurantiaco post anthesin eburneo, labello recurvato ligulato fimbriato, petalis obovatis ad apicem fimbriatis, fimbriis plerumque furcatis, calcari obtuso 5–6 mm longo, sepalo medio integro, sepalis lateralis valde reflexis differt.

Plants (20–)29–65(–84) cm tall, glabrous and distinctly glaucous; *lower leaves* 2–3, sheathed, strongly keeled, conduplicate, to 25(–30) cm long and 3(–5) cm wide when flattened; *upper leaves* reduced to 3–5 linear bracts below the inflorescence. *Inflorescence* racemose, (18–)24–80(–112)-flowered, (5–)10–20(–27) cm long, 2.5–4 cm diam., densely flowered except in very tall individuals; lower floral bracts usually equal to or often exceeding the pedicellate ovary and decreasing in length upward, about 2.2 cm long. *Perianth* very pale orange-yellow in bud opening to pale cream, petals and lip often aging to a deeper creamy yellow or fading to a dull white; *lateral sepals* 3 mm long, 3 mm wide, reflexed, widest at the middle and tapering to a rounded apex and truncated base; *dorsal sepal* 3 mm long, 3 mm wide, concave, entire and arching forward to partially enclose the fringed petals; *petals* obovate, 3.25 mm long, 2 mm wide, fringed at the tip, the fimbriae usually forked and clearly visible to the sides of the dorsal sepal; *lip* ligulate, 3 mm long, 2 mm wide (exclusive of fringe); recurved or, rarely, descending, the margin with forked fimbriae up to 3 mm long, the fimbriae near the base perpendicular to the lip; *spur* 5–6 mm long, tubular, strongly curved, either obtuse or bulbous at the tip; nectary orifice T-shaped; *column* with the viscidia 2.5–3 mm apart; *fruit* a capsule, 1–1.6 cm long.

Illustration. Photograph in Rickett (1966: plate 20) as *Habenaria cristata*.

Distribution and ecology. Currently known only from the Town of East Hampton, Suffolk County, Long Island, New York. Plants growing in dry, interdunal hollows and dune slopes (but never swales); usually with *Pinus rigida*, *Quercus velutina*, *Cladonia* sp., *Smilax glauca*, *S. rotundifolia*, *Toxicodendron radicans*, *Hudsonia ericoides*, *Danthonia* sp., *Agrostis* sp., *Minuartia caroliniana*, *Arctostaphylos uva-ursi*, *Vaccinium corymbosum*, and *Cypripedium acaule*.

Etymology. The term *pallida*, pale, is chosen for its appropriate description in comparison to *P. cristata* (Michaux) Lindley and other brightly colored, related species. In the past, these plants have commonly been called the "pale cristata" or "pale fringed orchis." The latter is recommended for a common name.

Paratypes. UNITED STATES. NEW YORK: Long Island, Suffolk County, Town of East Hampton–East Hampton, 23 Sep. 1928, *R. Latham 5995* (NYS); East Hampton, 16 Aug. 1929, *R. Latham 6634* (NYS), *G. E. Lotowycz*, *J. Hoar*, 4 Aug. 1985(OBPF 9782); Montauk, 11 Aug. 1928, *R. Latham 5782* (NYS), 12 Aug. 1928, *R. Latham 5782* (NYS); Montauk Point, *C. S. Bryan*, Aug. 1948 (AMES 80811); Montauk, *C. K. Brooks et al.*, 1 Aug. 1951 (AMES 66346), *G. E. Lotowycz*, 18 Aug. 1978 (OBPF 8985), 15 Aug. 1979, *C. J. Sheviak et al. 1615* (NYS); Napeague, *R. Latham*, 30 July 1928 (NYS), 11 Aug. 1928, *R. Latham 5781* (NYS), *R. Latham*, 16 Aug. 1929 (NYS), 16 Aug. 1929, *R. Latham 7084* (NYS), 18 Aug. 1929, *R. Latham 7021* (NYS), *G. E. Lotowycz*, 18 Aug. 1975 (OBPF 8111), 15 Aug. 1979, *C. J. Sheviak et al. 1606* (NYS), 17 Aug. 1984, *R. E. Zaremba 1503* (NYS), *G. E. Lotowycz*, 4 Aug. 1985 (OBPF).

Platanthera pallida is distinguished from other closely related taxa by the following key.

KEY TO THE SMALL-FLOWERED (LIP LESS THAN 9 MM LONG), FRINGED SPECIES OF *PLATANTHERA* SECT. *BLEPHARIGLOTTIS* OF NORTH AMERICA

1a. Spur less than 10 mm long; shorter than ovary.
  2a. Lip recurved, lateral sepals reflexed, dorsal sepal entire, spur 5–6 mm long, obtuse;

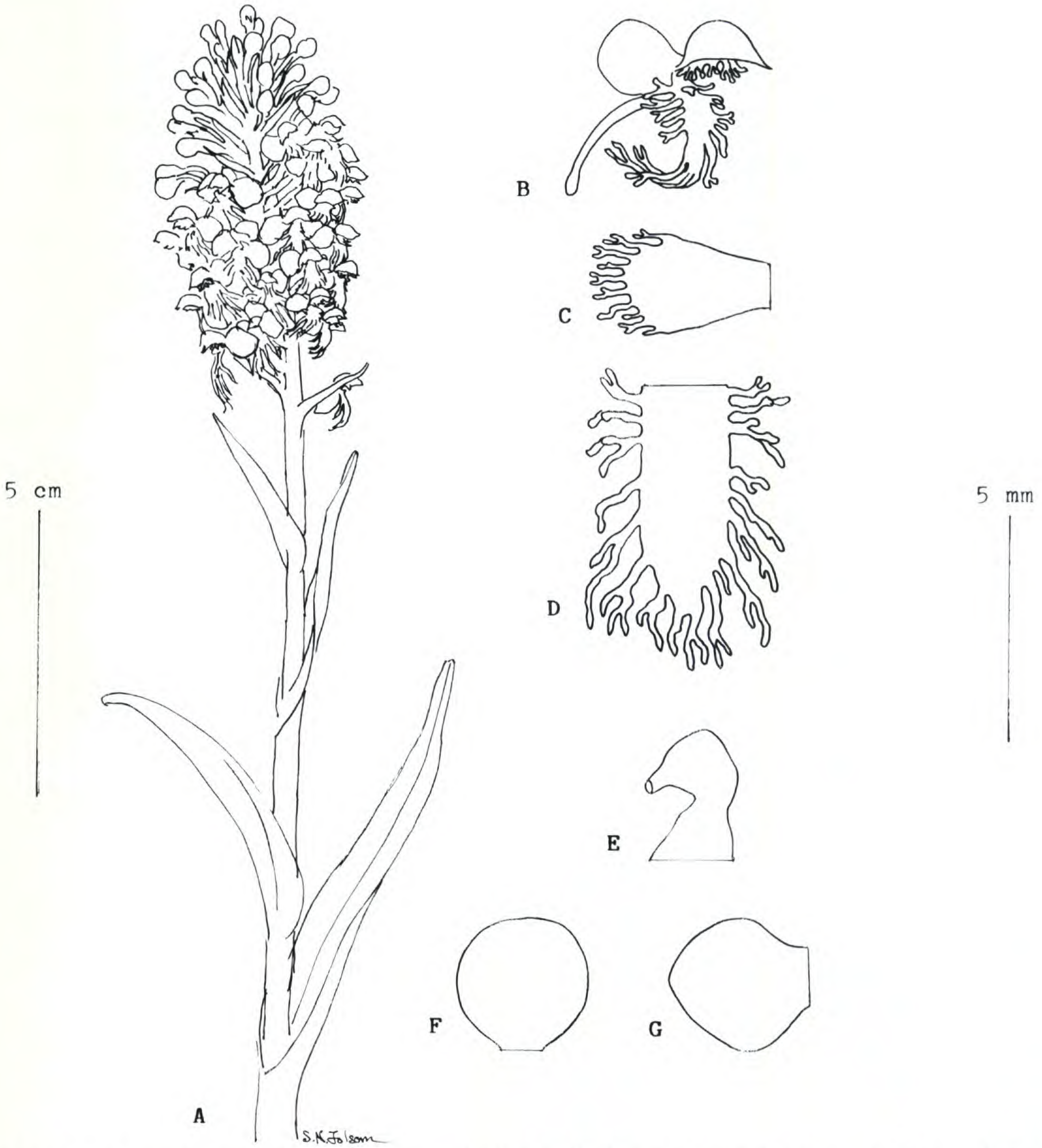

Figure 1. *Platanthera pallida* P. M. Brown. —A. Habit —B. Perianth, front/side view. —C. Petal. —D. Lip. —E. Column, side view. —F. Dorsal sepal. —G. Lateral sepal.

perianth cream-colored . . . . . .
. . . . . *Platanthera pallida* P. M. Brown

2b. Lip projecting forward, lateral sepals porrect, dorsal sepal emarginate, spur 7–8 mm long, acute; perianth orange to yellow . . . . . *Platanthera cristata* (Michaux) Lindley

1b. Spur greater than 10 mm long; exceeding ovary; perianth pale orange, yellow, cream or nearly white.

3a. Spur 10–15 mm long, exceeding ovary . . . *Platanthera* ×*canbyi* (Ames) Luer

3b. Spur greater than 15 mm long; greatly exceeding the ovary; raceme usually 3 cm or more in diameter . . . .
. . . . . *Platanthera* ×*bicolor* (Raf.) Luer

The simple-lipped, fringed species of *Platanthera* constitute a significant part of section *Blephariglottis*, and are some of the showiest members of the Orchidaceae in eastern North America. Of the five species that comprise this group, three, *P. blephariglottis* (Willd.) Lindley, *P. ciliaris* (L.) Lindley, and *P. cristata*, are widespread throughout the East (Luer, 1975), while two, *P. chapmanii* (Small)

Luer emend. Folsom (Folsom, 1984) and *P. integrilabia* (Correll) Luer (Zettler & Fairey, 1990), are of restricted and local distribution. *Platanthera blephariglottis* includes variety *blephariglottis*, variety *conspicua* (Nash) Luer, and forma *holopetala* (Lindley) P. M. Brown (Brown, 1988). Three putative hybrids occur, *P.* ×*bicolor* (Raf.) Luer (*P. blephariglottis* var. *conspicua* × *P. ciliaris*), *P.* ×*canbyi* (Ames) Luer (*P. blephariglottis* var. *conspicua* × *P. cristata*) (Luer, 1975), and *P.* ×*channellii* Folsom (*P. ciliaris* × *P. cristata*) (Folsom, 1984). Several other hybrids have been reported, but none have received binomials. The description of *Platanthera pallida* (Fig. 1) adds a new species to this list.

Growing among *Pinus rigida* in dry, interdunal hollows on eastern Long Island, New York, is a *Platanthera* with small flowers, short spur, and a superficial resemblance to *P. cristata*. The most obvious difference is the uniform pale cream color of the small flowers. Unlike typical *P. cristata* in the north, the plants are locally abundant.

Detailed examination and observations of *P. cristata* throughout its range, including all known populations from Long Island, have been made to see if they reveal morphological differences. Measurements were taken of the critical characters, i.e., petals, sepals, lip, spur, cilia, and column, of 327 herbarium specimens and 128 living specimens, including 78 plants growing on Long Island. Numerous photographs and drawings, published and unpublished, were also reviewed. Special attention was given to those designated as "light yellow or pale" in coloration. With the exception of the plants in question, all specimens and living material examined fell well within the criteria for typical *P. cristata* (Correll, 1950; Luer, 1975).

Sheviak suspected that the pale plants from eastern Long Island were polyploid and of hybrid origin. He collected material, did a chromosome count, and determined that they are diploid with a count of $2n = 42$ (*C. Sheviak 1606*, NYS).

Herbarium specimens and living plants of the northern hybrids, *P.* ×*canbyi*, *P.* ×*bicolor*, and *P. ciliaris* × *P. blephariglottis* var. *blephariglottis* (reported from Michigan), were also examined to see if they might be similar to the Long Island plants. They were found to be distinct in all respects.

Platanthera pallida shows insufficient features to assume its parentage is the same as *P.* ×*canbyi*. Although the small flower size and pale coloration can be found in many plants of *P.* ×*canbyi*, the longer spur characteristic of that hybrid is lacking in *P. pallida*. The reflexed sepals and recurved lip, which are critical features of *P. pallida*, are also present in *P. blephariglottis* var. *blephariglottis*. Comparison with plants from Michigan that appeared to be the cross between *P. ciliaris* and *P. blephariglottis* var. *blephariglottis* showed no similarities; the putative hybrids are much larger than *P. pallida* and the spur much longer, as it is in both parents.

One of the remarkable aspects of *P. pallida* is the uniformity of its floral morphology. All the critical floral characters, i.e., perianth dimensions, color, positioning of floral parts, have little, if any, variation throughout all populations.

Platanthera pallida occurs as three populations in two sites in the Town of East Hampton, eastern Long Island. The plants appear to have been first discovered by Roy Latham in 1926 (Latham, 1940). By 1948, and in subsequent years, the stations had been visited by several botanists and orchid enthusiasts (Lamont et al., 1988).

Latham's initial site near Montauk supports two distinct current populations. They are separated by nearly ¼ mile of duneland. In each of these populations the plants are widespread and somewhat scattered, but retain their habitat preference. Adjacent to the areas that support *P. pallida* are numerous swales and bogs. Typical *P. cristata*, if present, would be found in these wetter areas, as it is in the Pinelands of New Jersey, a region of similar topography. Careful searches have revealed no other species of *Platanthera* in either the immediate area or for several miles around.

The other population is located west of Napeague Harbor. Several specimens collected by Latham (NYS) in 1928–1929 and simply labeled "Napeague" may be from this site. It was not until 1975 that G. E. Lotowycz found the current site and collected her first specimen—as *P. cristata*—from there. In contrast to the Montauk site, where the plants are widely scattered, here *P. pallida* is concentrated in a much smaller area and in larger numbers. Again, there are adjacent swales and small bogs, but no other *Platanthera* species to be found. Companion plants are essentially the same in both locales. *Platanthera pallida* is consistently observed to be restricted to the oldest, most stable *Pinus rigida* stands within the dunes.

Acknowledgments. I thank Charles J. Sheviak (NYS), Paul M. Catling (DAO), Gustavo A. Romero (AMES), and one anonymous reviewer for encouragement and helpful suggestions; Stanley N. Folsom for the illustrations, assistance, and patience; and the following students and friends who accompanied me on field trips and/or loaned slides and made helpful suggestions: Joann and Fred Knapp (who

first led me to the plants), Roger Bradley, Hal Horwitz, Philip Keenan, Eric Lamont, Juliet Perkins, Moreno and Dorothy Tagliapietra-Cherbavaz, Nancy Webb, and Joseph Welch.

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Orchidaceae Dunstervillorum V: Two New Species and a New Combination in *Epidendrum* from the Venezuelan Guayana

Germán Carnevali

Fundación Instituto Botánico de Venezuela, Herbario Nacional de Venezuela (VEN), Aptdo. 2156, Caracas 1010-A, Venezuela; present address: Missouri Botanical Garden, P.O. Box 299, St. Louis, Missouri 63166-0299, U.S.A.

Gustavo A. Romero

Oakes Ames Orchid Herbarium, Harvard University Herbaria, 22 Divinity Avenue, Cambridge, Massachusetts 02138, U.S.A.

ABSTRACT. Two new species and a new combination are required for the treatment of *Epidendrum* for the *Flora of the Venezuelan Guayana*. The new species are *Epidendrum caurense* and *Epidendrum nuriense*. *Neolehmannia pabstii* is transferred to *Epidendrum*, with the new name *Epidendrum dichaeoides*. All three species are illustrated with previously unpublished plates by the late G. C. K. Dunsterville. Comments on affinities and geography are provided for all species.

Although several authors (Barros, 1982; Dunsterville & Garay, 1976; Garay, 1977; Pabst, 1978) assign subtribal rank to some groups of the subtribe Laeliinae (members of former subtribes Epidanthinae L. O. Williams, and Stenoglossinae Benth.) that display well-developed viscidia, most modern orchidologists (e.g., Dressler, 1984; Hagsater, 1985) agree that most members of *Epidendrum* sensu lato display variously developed viscidia and that the difference between the proposed subtribes Epidanthinae and Stenoglossinae, and the Laeliinae is one of degree. There is a consensus in including most members of the Epidanthinae and Stenoglossinae, genera such as *Epidanthus* L. O. Williams, *Amblostoma* Scheidw., *Nanodes* Lindley, *Neolehmannia* Kränzlin, *Stenoglossum* Kunth, and *Kalopternix* Garay & Dunsterv., in the genus *Epidendrum* itself. Each of these segregate genera is apparently closer to a different group within the genus *Epidendrum*, and not to the other members of the Epidanthinae or Stenoglossinae, rendering Dunsterville & Garay's (1976) circumscription of these subtribes artificial. Another genus included in the Stenoglossinae, *Cladobium* Lindley, containing the sole species *C. violaceum* Lindley, clearly belongs in the genus *Scaphyglottis* Poeppig & Endl. because of its vegetative and floral morphology. *Scaphyglottis*, although a member of the Laeliinae, is only distantly related to *Epidendrum* and the other former members of the Stenoglossinae.

The broad circumscription of the genus *Epidendrum* followed in the Orchidaceae treatment for the *Flora of the Venezuelan Guayana* requires the inclusion of the new species *Epidendrum caurense* (belonging to the *Amblostoma* group) and the transfer of *Neolehmannia pabstii* P. Braga to *Epidendrum*.

Epidendrum caurense Carnevali & G. Romero, sp. nov. TYPE: Venezuela. Bolívar: Río Caura, in rainforest close to Las Pavas Falls, where Upper Río Caura separates from the Lower, ca. 300 m, May 1976, collected originally by F. B. Stevens, *Dunsterville & Dunsterville 1354* (holotype, AMES). Figure 1.

Species haec *Epidendro lanipes* Lindley similis sed ramas inflorescentia laxioribus, pubescentia rachidis laxioribus, floribus minoribus pallide flavo-viridis, lobo centrali oblongo non pandurato vel cuneato, carina centrali brevioris discrepat.

Epiphytic herb; rhizome shortly repent, with the pseudobulbs ± aggregate. Pseudobulbs 30–50 cm long, erect, homoblastic, slenderly fusiform, 3–8-leaved in the upper half. Leaves 15–25 × 1.5–2 cm, linear-elliptic, acute, subtended by a tubular sheath, midnerve finely sulcate and sharply carinate, blades generally ascending when young, tending to droop when fully grown. Inflorescence terminal, 25–30 cm long, an arcuate panicle with slender, somewhat divaricate, subdensely many-flowered branches; peduncle remotely sheathed, terete, glabrous; rachis with scattered, irregular, moniliform hairs; floral bract ca. 3 × 2 mm, glabrous, ovate, obtuse. Pedicellate ovary 7.5–8 mm long, densely covered with moniliform hairs. Flowers resupinate or not, light yellowish green, with widely spreading perianth

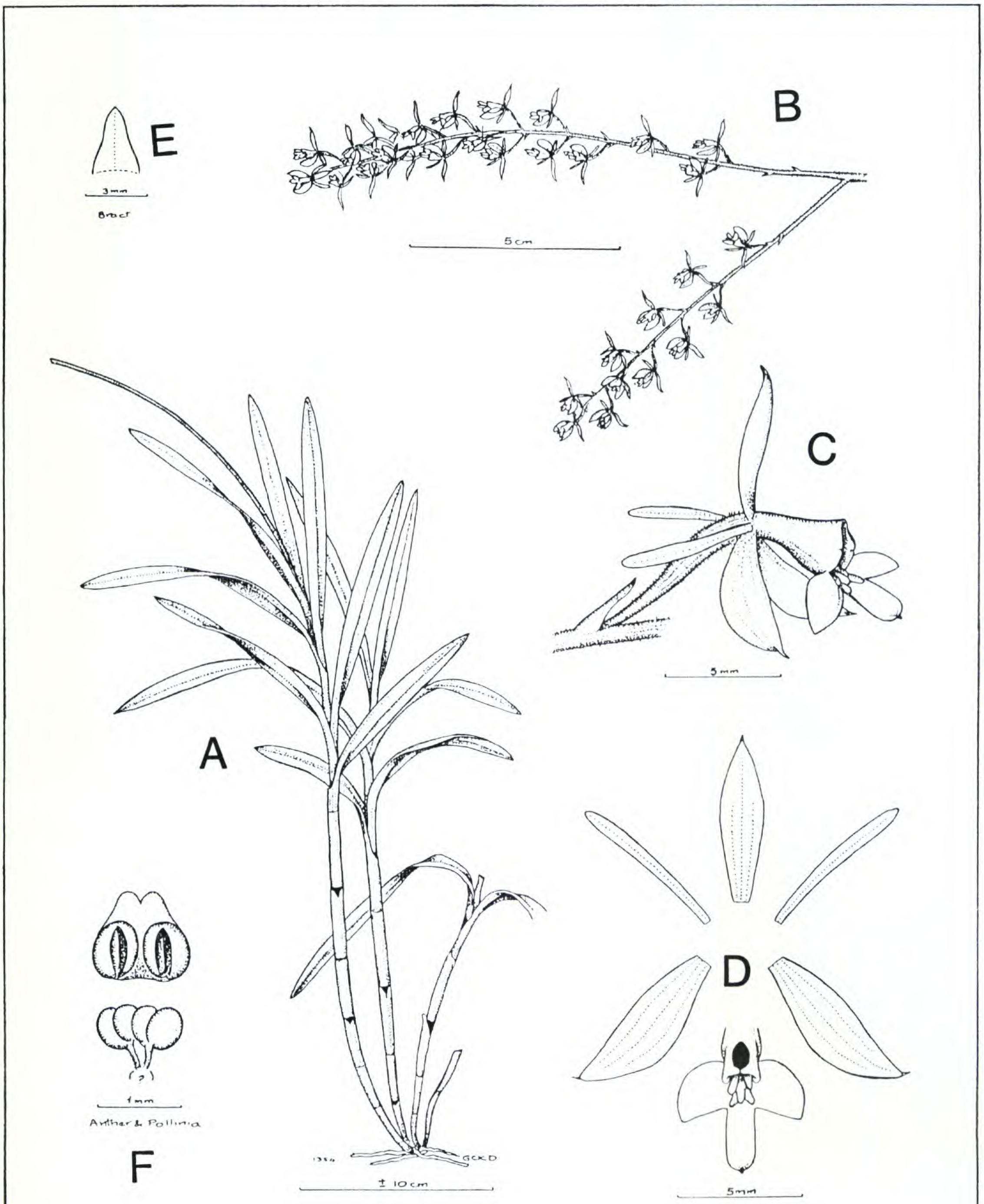

Figure 1. *Epidendrum caurense* Carnevali & G. Romero. —A. Habit. —B. Upper portion of the inflorescence. —C. Flower, lateral view. —D. Floral segments, spread. —E. Floral bract. —F. Anther and pollinia.

segments; sepals ca. 7 mm long, 3-nerved, apex sharply mucronate, dorsal ca. 1.9 mm wide, narrowly elliptic, acute, acuminate, laterals ca. 2.3 mm wide, obliquely elliptic-oblanceolate, acute; petals slightly shorter than the sepals, ca. 0.6 mm wide, linear-oblanceolate, obtuse, 1-nerved, set at variable angles to the column. Labellum fused to column throughout the length of the latter, the free portion ca. 4.5 × 5 mm, sharply 3-lobed; lateral lobes obliquely ovate, ca. 2.5 × ca. 2 mm; central lobe

ca. 2.2 × ca. 1.5 mm, oblong, apex rounded or obtuse, mucronate; disk of the labellum with 2 basal calli and 3 thickened keels, the central keel shorter or subequaling the lateral ones. Column ca. 4.5 mm long, thickened apically; anther ca. 1.2 mm long, consisting of a fairly thin plate bearing 2 separate, thin, bilocular, suborbicular cells; pollinia in 2 slightly asymmetrical pairs, only slightly compressed, each pair on a single caudicle, the caudicles arising from a common point on a viscidium whose form is completely distorted after removal from the split rostellum.

This new species belongs to the *E. amblostomoides* group of *Epidendrum* (E. Hagsater, pers. comm.), which is often included within the former genus *Amblostoma* (or *Amblostoma* group of *Epidendrum*, Dressler, 1984) but is recognized here as distinct. Both groups are characterized by their thickened column, almost spheroid pollinia, and well-developed viscidia. The *Amblostomoides* group is characterized by membranous, mostly pubescent flowers, while in the mostly Brazilian *Amblostoma* group the flowers are glabrous and (especially the labella) very fleshy. All the species of the *Amblostomoides* group have fusiform or cylindrical pseudobulbs, usually paniculate inflorescences with densely flowered, divaricate branches, and a commonly pubescent pedicellate ovary. *Epidendrum caurense* seems closest to *E. lanipes*, from Bolivia, Peru, Ecuador, and Colombia. From this species, *E. caurense* differs by its less dense inflorescence, the less dense pubescence of the pedicellate ovary, its smaller sepals (ca. 7 mm long vs. 10–12 mm long), pale yellow-green flowers (vs. white), the shape of the labellar callus (see below), and its oblong central lobe (vs. cuneate or obovate). The callus of *Epidendrum lanipes* has a central keel and two lateral ones; these lateral calli can be entire or bicallose, thus making the entire callosity 5-keeled. The central keel is always longer than the lateral keels. In *E. caurense* there are always five keels but the lateral keels are longer or subequal to the central keel.

Epidendrum lanipes is known from elevations of 800–1,400 m (Dodson & Bennett, 1990: 64), while *E. caurense* is known only from elevations below 300 m. *Epidendrum purum* Lindley, distributed from Venezuela to Bolivia, is also similar but has white flowers, a glabrous rachis, and pedicellate ovary. Other similar species are *E. amblostomoides* Hoehne, from Goiás, Brazil, and *E. subpurum* Reichb. f. from northern Venezuela. However, both species have a shorter, broader, emarginate central lobe and glabrous rachis and pedicellate ovary.

A specimen from Río Orejas, La Teta, Upper Cauca, Colombia, *Lehmann 6938* (AMES, NY), could represent another population of *Epidendrum caurense*.

Epidendrum dichaeoides Carnevali & G. Romero, nom. nov. Replaced name: *Neolehmannia pabstii* P. Braga, Bradea 3: 171. 1981, non *Epidendrum pabstii* A. Hawkes, 1957. TYPE: Brazil. Amazonas: Río Marié, 16 Oct. 1978, *Madison, Braga & Kennedy* (*PFF 365*) (holotype, INPA-85085). Figure 2.

This species, recently described from Amazonian Brazil, has been collected several times, mainly in the Casiquiare and Río Negro basins in the extreme south of Territorio Federal Amazonas of Venezuela. Here it is locally common, always growing pendent and low on trees in the rather open, low, humid forests that are usually contiguous to "banas." The plants are frequently purple-tinged or entirely wine-purple. An unusual feature of *Epidendrum dichaeoides* is that it frequently produces upper axillary inflorescences, besides the more normal terminal inflorescences. This character was not mentioned in the original description of *Neolehmannia pabstii*. Vegetatively, *Epidendrum dichaeoides* resembles *Epidendrum prostratum* (Lindley) Cogn. and related species (the former members of the genus *Physinga* Lindley), but it lacks the elongated inflorescence and the basal portion of the labellum does not enfold the lateral margins of the apex of the column. The similarities of *Epidendrum dichaeoides* and *E. prostratum* are more likely to be due to convergence (both occur in the same microhabitats) than to a close phyletic relationship, as *Epidendrum dichaeoides* is probably closer to species like *Epidendrum jejunum* Reichb. f., *E. viridibrunneum* Reichb. f., and *E. williamsii* Dodson, all included in Dunsterville & Garay's (1976) concept of the genus *Neolehmania*.

The new specific epithet suggests the conspicuous vegetative resemblance of this taxon to plants of the genus *Dichaea* Lindley.

Specimens examined. BRAZIL. AMAZONAS: Río Negro, caatinga at Porto Camanus, 19 Oct. 1978, *Madison et al. 6438* (SEL); Río Curicuriarí, ca. 10 km above the mouth, 25 Oct. 1978, *Madison et al. 6648* (SEL). VENEZUELA. TERRITORIO FEDERAL AMAZONAS: Departamento Atabapo, Caño Yagua, E del Cerro Yapacana, 3°3′N, 66°40′W, *F. Guánchez 1050* (TFAV); Departamento Casiquiare, Capihuara, *Ll. Williams 15570* (VEN); Departamento Río Negro, IVIC Study Area, 4 km NE of San Carlos de Río Negro, ca. 20 km SE of confluence of Río Negro and Brazo Casiquiare, 1°56′N, 67°03′W, 120 m, 10 Nov. 1977, *R. Liesner 3280* (MO, SEL, VEN),

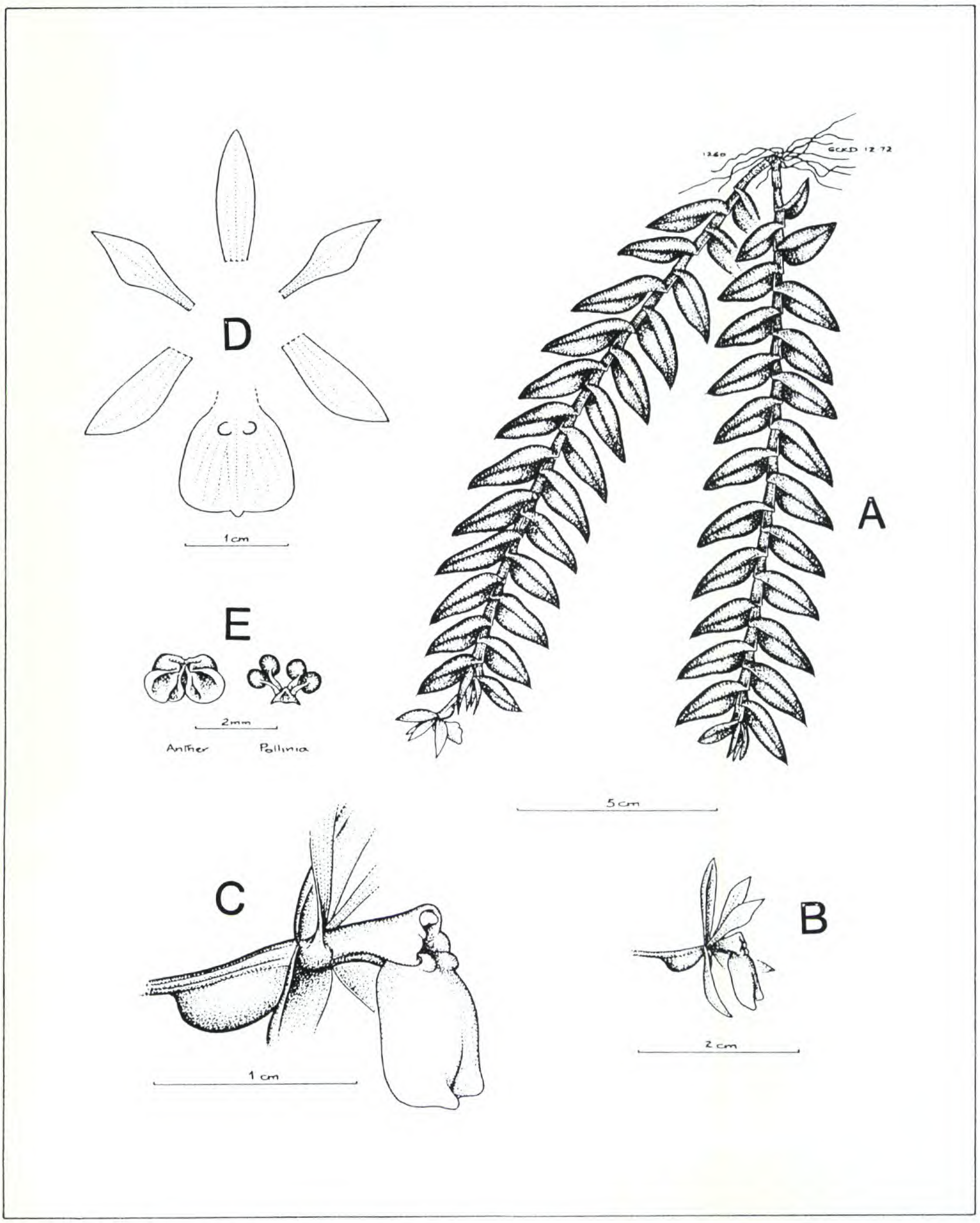

Figure 2. *Epidendrum dichaeoides* Carnevali & G. Romero. —A. Habit. —B. Flower, lateral view. —C. Detail of column, labellum, and vesicle. —D. Floral segments, spread. —E. Anther and pollinia.

9 Apr. 1979, *R. Liesner 6424* (MO, VEN), 11 Nov. 1987, *R. Liesner & G. Carnevali 22981* (MO, VEN), 5 Sep. 1988, *G. Carnevali & I. Ramírez 2763* (VEN), Mar.–Apr. 1981, *F. Delascio et al. 9483* (VEN), 17 Sep. 1975, *P. Berry 1361* (SEL, VEN); Río Ararí, 1°30′N, 65°13′W, 530–550 m, Nov. 1983, *F. Guánchez 2220*, (TFAV, VEN); Cerro La Neblina, Río Mawarinuma, 140 m, 15–18 Mar. 1984, *R. Liesner 16559* (MO, VEN), *W. Anderson 13362* (MICH, VEN); Río Extremo Sur, cerca de la confluencia con el Río Siapa, 1°50′N, 64°30′W, 520 m, *Dunsterville & E. Dunsterville 1260* (AMES, VEN).

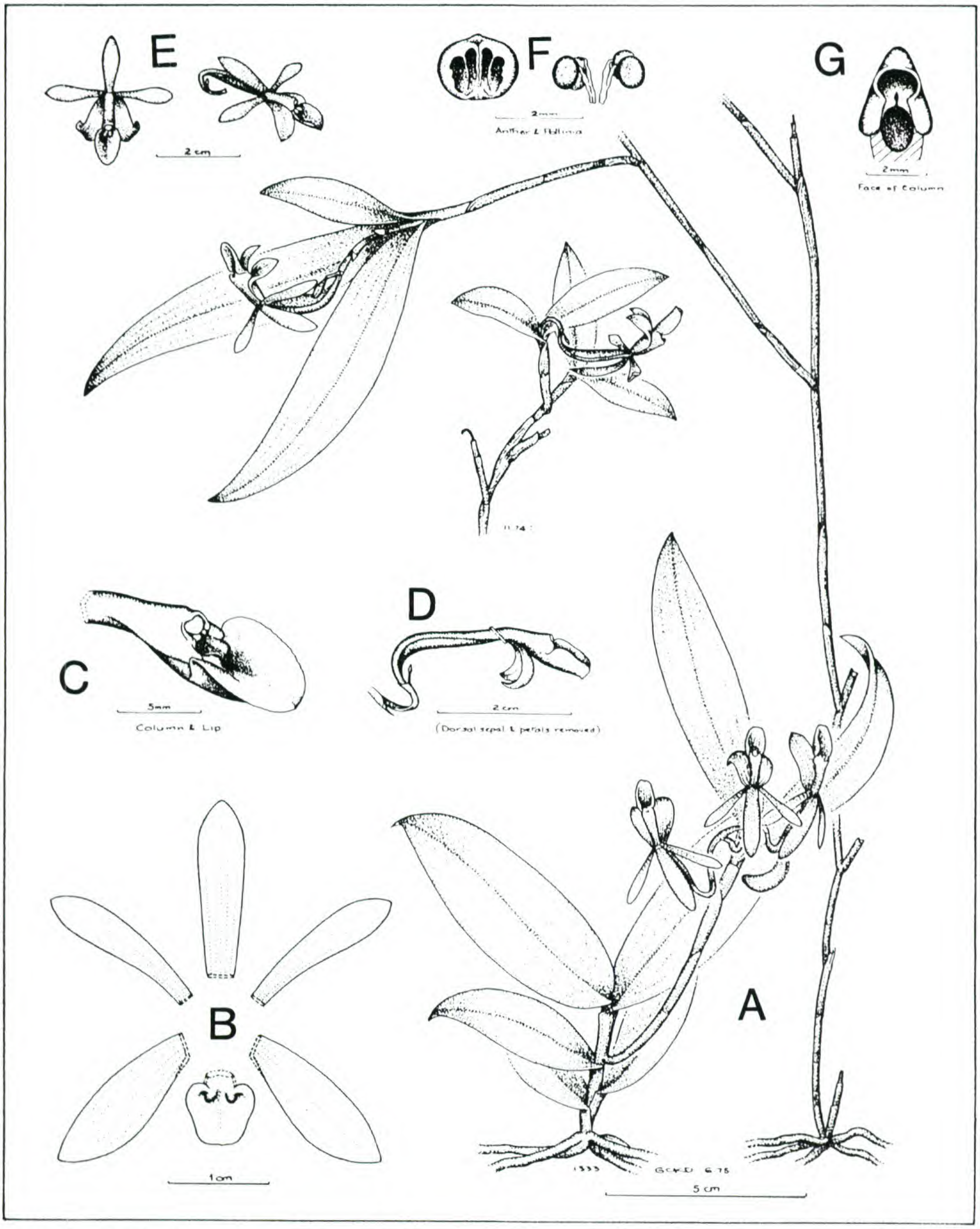

Figure 3. *Epidendrum nuriense* Carnevali & Hags. —A. Habit. —B. Floral segments, spread. —C. Column and labellum. —D. Lateral view of flower, dorsal sepal and petals removed. —E. Flower. —F. Anther and pollinia. —G. Column, ventral view.

Epidendrum nuriense Carnevali & Hags., sp. nov. TYPE: Venezuela. Bolívar: Altiplanicie de Nuria, apparently common in cloud forest at 600–700 m, *Dunsterville & E. Dunsterville 1333* (holotype, VEN; isotype, line drawing, AMES). Figure 3.

Herba epiphytica. Caules ex internodiis medianis producti, apice 2–3(–5) foliati. Flores 1–4, terminales, non resupinati. Ovarium incrassatum, basi incurvum. Sepala 5-nervata, lateralia basi columnae breviter connata. Petala 5-nervata, oblanceolata. Labellum 6–7 × 5–7 mm, ovatum vel ovato-ellipticum, basi cordatum, apice truncatum, disco pulvinato-bicalloso. *Epidendro lechleri* Reichb. f.

similis sed labello angustiore, inflorescentia laxiore pauciflora, planta floresque majore recedit.

Epiphytic herb, 7–40 cm high, with sympodial erect growth, branched. Roots produced only from the base of the basal stems, fleshy, thin, ca. 2.5 mm diam. Stems reedlike, cylindric, straight, produced from medial internodes of older stems, sympodial elements 2–15 cm long; concealed in gray, nervose, tubular sheaths to 5 cm long. Leaves 4–10 × 1.8–2.2(–3) cm, 2–3(–5) per stem, grouped toward stem apex, narrowly elliptic or rarely ovate, acute, margin entire, blades articulate with their laterally compressed, striate sheaths. Inflorescence terminal from the apex of fully mature stems, spathe absent, racemose or rarely branched, somewhat nutant; peduncle 1.5–3 cm long, laterally compressed, peduncle bracts 1 or 2, ca. 2 mm long, triangular; rachis fractiflex, laterally compressed. Flowers not resupinate, 1–3(–4) in the raceme, opening simultaneously; sepals and petals bronze-green, nerves somewhat darker; labellum shiny, bronze-colored with green calli; column green, apically pink; anther cream-color. Floral bracts ca. 2 mm long, amplexicaul, triangular. Pedicellate ovary 1.8–2.5 cm long, longitudinally swollen ventrally, terete, smooth, basally incurved. Sepals 5-nerved, fleshy, rugulose without, dorsal keel poorly developed; dorsal sepal 17–18 × 4 mm, reflexed over ovary, narrowly obovate, apex obtuse, margins not revolute; lateral sepals 17–18 × 5–6 mm, partially fused with column at base, then reflexed, elliptic to obovate-elliptic, apex subacute to acute, slightly falcate, margins revolute; petals 17 × 4 mm, 5-nerved, less fleshy than sepals, spreading or reflexed, narrowly obovate-elliptic, apex obtuse, slightly falcate, margins extended or somewhat revolute. Labellum fused to column throughout the length of the latter, fleshy, blade 6–7 × 5–7 mm, ovate to ovate-elliptic, basally cordate, apically truncate, margins finely erose, basally provided with 2 small, pulvinate calli, without keels, marginally thinner than the rest of the blade. Column ca. 10 mm long, slightly bent toward base, clinandrium very small, entire; rostellum near column-apex, slitlike; lateral lobes of column convex-truncate. Nectary very deep. Anther ovoid, without ornamentation, 4-locular. Pollinia 4, subglobose, somewhat compressed, subequal, caudiculae slightly longer than pollinia, viscidium semi-liquid. Capsule unknown.

This species belongs to the *Epidendrum arbuscula* Lindley group, which is characterized by the stems branching around the middle portion and producing roots from the base of the most basal stems; the architecture of the plant is thus termed "sympodial erect growth" (Hagsater, 1987). *Epidendrum nuriense* does not have close allies in the Guayana Shield. The only other species in the area with a similar branching pattern is *Epidendrum lechleri* Reichb. f. This species, however, has denser inflorescences, smaller flowers, and a proportionally much broader labellum. *Epidendrum megagastrium* Lindley, from Andean Peru and Ecuador, resembles *E. nuriense* because of its habit and longitudinally swollen ovary, but the Andean species comes from much higher elevations (2,500–2,700 m), has denser inflorescences, and an acuminate or acute labellum. *Epidendrum macrogastrium* Kränzlin from Peru is possibly related to *E. nuriense* but comes from higher elevations in the Andes (2,700–2,900 m), has smaller flowers, and a differently shaped (very broadly cordate), much broader labellum.

Epidendrum nuriense seems to be restricted to the eastern portion of Estado Bolívar, Venezuela, where it is apparently common in the Altiplanicie de Nuria, and more scarce in La Escalera, where the senior author and Carlos García Esquivel collected living material that is currently under cultivation.

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A New Species of Cyperaceae (Cryptangieae) from the Venezuelan Guayana

Gerrit Davidse
Missouri Botanical Garden, P.O. Box 299, St. Louis, Missouri 63166, U.S.A.

ABSTRACT. *Lagenocarpus amazonicus* (Cyperaceae), from Amazonas, Venezuela, is described and illustrated. It differs most notably from other species of section *Junciformes* in its strongly pubescent rhizome sheaths and connate stamen filaments.

Lagenocarpus Nees is a tropical American genus of the tribe Cryptangieae that has been most recently revised by Koyama & Maguire (1965) and Koyama (1972), who recognized 28 species in four sections. The genus has two centers of species diversity: the Guayana region and southeastern Brazil in the area between the states of Bahia, Minas Gerais, and São Paulo.

A review of the genus for the *Flora of the Venezuelan Guayana* brought to my attention a previously unrecognized species that I am naming *L. amazonicus*, based on its occurrence in Territorio Federal Amazonas, Venezuela.

Lagenocarpus amazonicus Davidse, sp. nov. TYPE: Venezuela. Territorio Federal Amazonas: Depto. Río Negro, Cerro Aratitiyope, aprox. 70 km al SSW de Ocamo, 2°10′N, 65°34′W, con riachuelos afluente al río Manipitare, piedra ignea, 990–1,670 m, 24–28 Feb. 1984, *J. Steyermark, P. Berry & F. Delascio 130049* (holotype, MO; isotypes, NY, VEN). Figure 1.

Herba perennis rhizomatosa, rhizomate 8–14 mm in diametro squamis dense pubescentibus obtecto, culmis 22–78 cm longis, basin 1.7–2.9 mm latis. Laminae foliorum 3–7.5 cm longae, 2.0–4.0 mm latae. Spiculae masculinae 4–5.5 mm longae; glumis 3.2–4.5 mm longis; staminibus 2, filamentis connatis, antheris 1.4–1.7 mm longis. Spiculae femineae 2.5–3.0 mm longae; glumis 3–4, 2.0–3.0 mm longis. Achenia 1.8–2.3 mm longa, laevia vel minute papillosa apicem versus; basi styli 0.3–0.4 mm longa, cylindrica, puberula apicem versus.

Perennial, rhizomatous, monoecious herb. Rhizomes 9 cm long, 8–14 mm thick, horizontal, producing numerous, slender roots, the segments short and swollen and covered by densely appressed-pubescent scales. Culms 22–78 cm long, 1.7–2.9 mm wide at the base, erect, trigonous, glabrous; nodes numerous; lower 4–6 internodes elongated to 15 cm, bearing somewhat loose, bladeless sheaths toward the base, the blade more fully developed distally; upper 10–20 internodes not elongated, the sheaths closely overlapping and bearing fully developed blades. Sheaths closed, puberulent or glabrous, eligulate; contraligule 0.5–1.5 mm, nerved to the apex; blades 3–7.5 cm long, 2.0–4.0 mm wide, widest at the base, divergent, acuminate, abaxially puberulent along the midvein. Inflorescences small, unbranched to 3-branched umbellate clusters borne from the uppermost nodes, with the pedicels or branches exserted from the sheaths. Spikelets unisexual. Male spikelets 4–5.5 mm long, 0.7–1.1 mm wide, solitary, binary, or rarely ternate, borne from nodes below those bearing the female spikelets, oblong-ellipsoid, dark brown, many-flowered; male floral bracts 3.2–4.5 mm long, 1–1.3 mm wide, densely imbricate, lanceolate, membranous, 1-nerved, the lower sterile and aristate to 1 mm, the 2 or 3 distal fertile and subtending male flowers, smaller and more delicate. Male flowers consisting of 2 stamens; filaments slightly longer than the subtending floral bract, connate; anthers 1.4–1.7 mm long, separate, basifixed, with a minute tuft of hairs at the apex. Female spikelets 2.5–3.0 mm long, solitary or rarely binary; female floral bracts 3 or 4, 2.0–3.0 mm long, 0.6–1.1 mm wide, lanceolate to lanceolate-ovate, membranous, glabrous or puberulent on the midvein and apically ciliolate, 1-nerved, the lowermost with an awn to 1 mm long, the distal floral bracts shorter, thinner and with less developed awns or acute. Female flower a solitary pistil; styles 3. Achenes 1.8–2.3 mm long, 0.9–1.0 mm wide, about as long as the floral bracts, smooth or minutely papillose distally, obovoid, trigonous, each face with a basal depression; style base persistent, 0.3–0.4 mm long, cylindrical, minutely puberulent at the tip; perianth absent or rudimentary; ovary 0.8–0.9 mm long, 0.3 mm wide, oblong in outline, sharply trigonous.

Paratypes. VENEZUELA. AMAZONAS: Cumbre del Cerro Autana, 4°52′N, 67°27′W, 1,230–1,240 m, sabana y afloramientos expuestos, 20–22 Sep. 1971, *J. A. Steyermark 105151* (MO, VEN).

By virtue of its culms with many elongated internodes, the lower leaves with no or reduced leaf

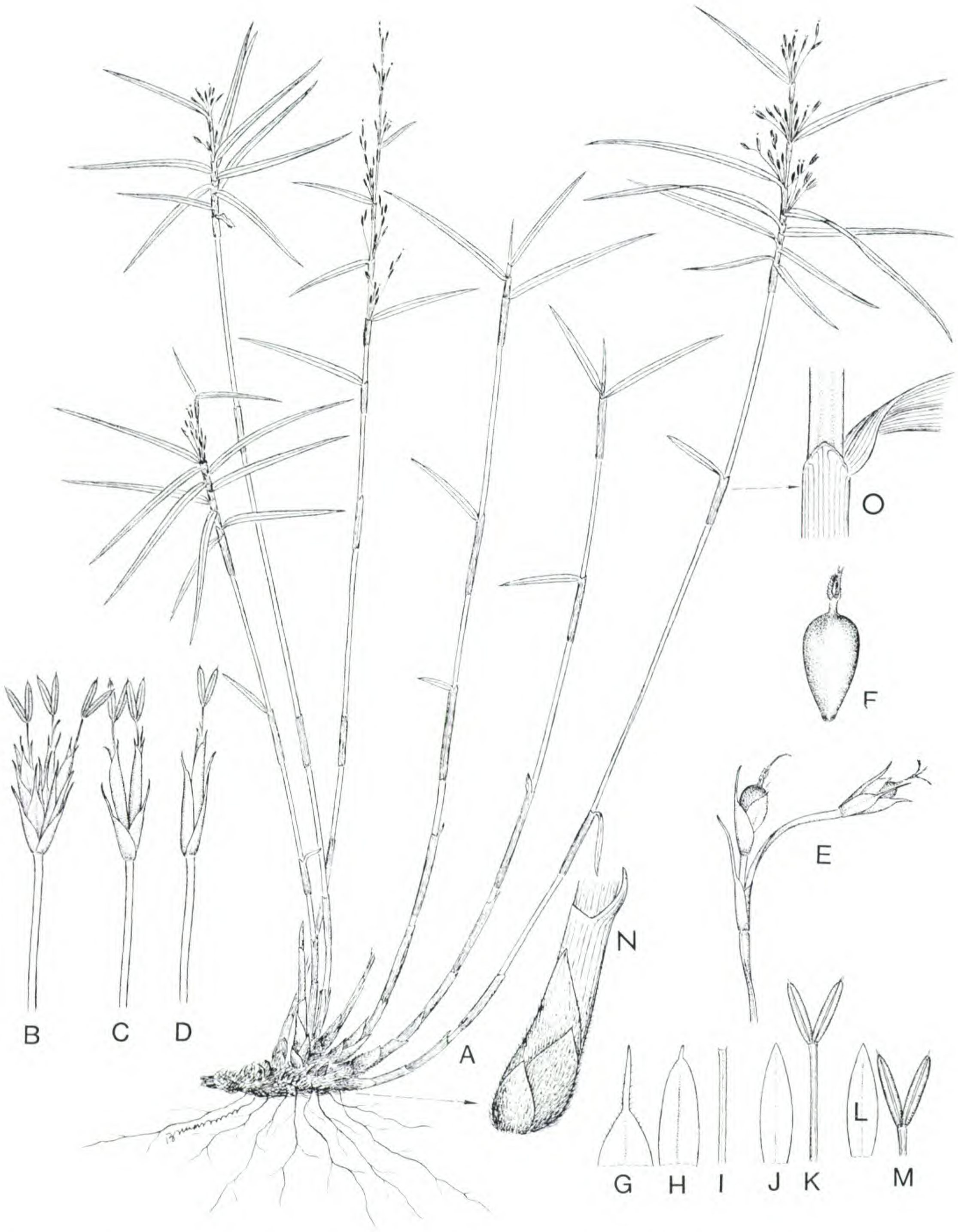

Figure 1. *Lagenocarpus amazonicus* Davidse. —A. Habit with the basal sheaths enlarged (N) to show the dense pubescence. B–D. Male spikelets at anthesis. —B. Three spikelets in cluster. —C. Two spikelets in cluster. —D. Solitary spikelet. —E. Female spikelets. —F. Achene. G–M. Dissection of male spikelet. —G. Lowest sterile floral bract. —H. Lowest fertile floral bract. —I. Lowest male flower consisting of 2 connate filaments with the anthers dehisced and fallen. —J. Middle fertile floral bract. —K. Middle male flower with 2 connate filaments and 2 separate anthers, near anthesis. —L. Upper fertile floral bract. —M. Upper male flower with the connate filaments not yet elongated. —N. Densely pubescent scales at the base of a culm. —O. Detail of leaf showing the contraligule.

TABLE 1. Characters that distinguish *Lagenocarpus junciformis* from *L. amazonicus*.

Character	*L. junciformis*	*L. amazonicus*
Rhizome scales	Glabrous	Densely appressed pubescent
Basal bladeless sheaths	Tight	Loose
Basal culm node width	0.6–0.9 mm	1.7–2.9 mm
Blade width	0.4–1.8 mm	2.0–4.0 mm
Filaments	Separate	Connate
Female floral bracts	4–5	3–4
Achene texture	Papillose	Smooth but apically minutely papillose
Achene length	1.4–1.9 mm	1.8–2.3 mm
Style base shape	Conical-cylindrical	Cylindrical
Style base length	0.1–0.2 mm	0.3–0.4 mm
Style base pubescence	Apically glabrous	Apically puberulent

blades, the fully developed leaves clustered toward the apex of the culms, the primarily terminal inflorescences (sensu Koyama, 1972), and the sharply trigonous achenes, this species belongs to section *Junciformes* Koyama, which Koyama (1972) considered to have five species.

This species is only known from the two cited collections, and Koyama (1972) considered one of these, *Steyermark 105151*, to be *L. junciformis* (Kunth) Kuntze. He thus believed *L. junciformis* to have a bimodal distribution, i.e., in the Planalto of Brazil and in the Venezuelan Guayana. However, the two cited Guayanan collections differ from the Brazilian collections of this species in the characters listed in Table 1.

Especially notable distinguishing characteristics of *L. amazonicus*, and ones in which this species differs from all the others in the section, are the strongly pubescent rhizome sheaths and the connate stamen filaments.

The fusion of the filaments is a feature previously unknown in the genus and is known to me only in two other genera of Cyperaceae: *Scleria* Bergius and *Rhynchospora* Vahl. In *Scleria* it has been reported in *S. melanomphala* Kunth, *S. bequaertii* De Wild., and *S. glabroreticulata* De Wild. (Piérart, 1951: pl. 1, fig. 30, pl. 2, figs. 2, 9), and in *Rhynchospora* it has been reported as "not unusual" in male flowers (Goetghebeur, 1986: 681), as, for example, in *R. confusa* Ballard (Ballard, 1934: t. 3250, fig. 4). That this feature is probably not a simple anomalous occurrence in *L. amazonicus* seems evident from the fact that all plants from the two known populations uniformly have it, even though they are separated by a distance of approximately 370 km.

Acknowledgments. I thank Bruno Manara for the excellent illustration and the curators at NY and VEN for the loan of specimens.

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New Species of *Festuca*, *Sporobolus*, and *Eriochloa* (Poaceae) from Mesoamerica and South America

Gerrit Davidse
Missouri Botanical Garden, P.O. Box 299, St. Louis, Missouri 63166-0299, U.S.A.

Richard W. Pohl
Department of Botany, 353 Bessey Hall, Iowa State University, Ames, Iowa 50011, U.S.A.

ABSTRACT. As a result of work on the Poaceae for *Flora Mesoamericana*, the following four new species are described, illustrated, and compared with their closest putative relatives: *Festuca talamancensis* from the Cordillera de Talamanca in Costa Rica, *F. herrerae* from the Cordillera de Talamanca in Costa Rica and Panama, *Sporobolus distichivaginatus* from the Petén, Guatemala, and *Eriochloa stevensii* from Nicaragua, Venezuela, and Ecuador.

In addition to the new species of grasses recently described as the result of a review of the Poaceae for *Flora Mesoamericana* (Davidse & Pohl, 1992), the following four species were found to be new and are here described, discussed, and illustrated for the first time. As in the earlier paper, the new species are published under the name of the person primarily responsible for the account of the taxon.

POAEAE

Twenty species of *Festuca* were accepted for *Flora Mesoamericana*, including the following two new species. Alexeev (1981, 1982) has most recently studied the genus for Mesoamerica. Of the five species that he described as new, three have been accepted for the *Flora Mesoamericana* treatment, and the other two were synonymized: *F. aguana* Alexeev (syn. *F. panamica* Alexeev), *F. cartagana* Alexeev, *F. swallenii* Alexeev, *F. willdenowiana* Schultes & Schultes f. (syn. *F. guatemalica* Alexeev).

Festuca herrerae Davidse, sp. nov. TYPE: Costa Rica. Limón: Cordillera de Talamanca, Atlantic slope, Kámuk massif, páramo NE of the Kámuk peak, 3,000–3,300 m, 9°16′–17′N, 83°00′–02°W, *Blechnum*-shrub association in *Chusquea-Hypericum* páramos, 17–18 Sep. 1984, *G. Davidse & G. Herrera Ch. 29291* (holotype, MO; isotypes, BM, CR, MEXU). Figure 1A–D.

Gramen perenne caespitosa innovationibus extra et intravaginalibus. Culmi 30–90 cm longi. Vaginae foliorum puberulae retrosum vel glabrae aliquantum fibrosae; ligula 0.3–2 mm longa; laminae 10–25 cm longae, 1–4 mm latae, planae vel plicatae, infra glabrae, supra parce scaberullae. Panicula 6–19 cm longa, 5–11 cm lata, laxa. Spiculae 6.6–9 mm longae; gluma infra 3.1–4.5 mm longa, 1-nervia; gluma supra 5–5.8 mm longa, 3-nervia; flosculi 3–5; lemmata 5.7–6.8 mm longa, 5-nervia, acuminatis, glabra dorsaliter scaberulla apicem versum; antherae 3, 1.6–2.1 mm longae; ovarium glabrum.

Loosely caespitose, perennial herb; innovations intra- and extravaginal; rhizomes not elongated. Culms 30–90 cm long, hollow, sparsely scaberulous below the nodes; elongated internodes 2–5. Sheaths retrorsely puberulent (in the lower leaves) to glabrous, stramineous to brown, slightly fibrous in age, the margins free; auricles absent; ligule 0.3–2 mm long, ciliate, membranous, the lateral extensions to 0.6–2 mm long; blades 10–25 cm long, 1–4 mm wide, flat to folded, glabrous below, sparsely scaberulous above; abaxial and adaxial sclerenchyma girders well developed. Panicle 6–19 cm long, 5–11 cm wide, open, lax, erect; axis scaberulous; lowest panicle branches 4–5 cm long, solitary or paired, spreading and drooping at the tips; pedicels scaberulous. Spikelets 6.6–9 mm long; lower glume 3.1–4.5 mm long, subulate, 1-nerved; upper glume 5–5.8 mm long, narrowly lanceolate, 3-nerved; florets 3–5; lemmas 5.7–6.8 mm, obscurely 5-nerved, glabrous on the back, scaberulous at the tip, entire, acuminate, unawned; palea as long as the lemma to 0.7 mm shorter, scaberulous on and between the keels near the tip, nearly glabrous toward the base, bidentate, the margins glabrous; stamens 3, the anthers 1.6–2.1 mm long; ovary glabrous; styles 2, terminal, separate, long-plumose in the upper $^{9}/_{10}$. Caryopsis 2.9–3 mm long, 0.8 mm wide, dark brown, glabrous, convex on the embryo side, sulcate the entire length on the hilum side; embryo $^{1}/_{10}$–$^{1}/_{5}$ as long as the caryopsis; hilum ca. $^{7}/_{10}$ as long as the caryopsis.

Paratypes. COSTA RICA. LIMON: Cordillera de Talamanca, Atlantic slope, Kámuk massif, main SW ridge

Figure 1. *Festuca* species. A–D. *F. herrerae* Davidse. —A. Habit. —B. Spikelet. —C. Uppermost fertile floret and the ultimate reduced sterile floret. —D. Caryopsis. E, F. *F. talamancensis* Davidse. —E. Uppermost fertile floret and the ultimate reduced, sterile floret. —F. Spikelet. (A based on *Davidse & Herrera 29291*, B–D on *Davidse et al. 25354*, E, F based on *Davidse 24776.*)

from Kámuk peak to Cerro Dudu, 3,000–3,300 m, 9°15′–16′N, 83°02′–04′W, *Blechnum*-shrub páramo, 19 Sep. 1984, *Davidse & Herrera Ch. 29369* (MO); Cordillera de Talamanca, Cerro Kámuk massif, between Cerro Dudu and Cerro Apri, 2,900–3,100 m, 9°14′30″–15′30″N, 83°03′30″–04′30″W, shrub páramo dominated by *Diplostephium, Blechnum* and other shrubs 1½–2 m tall, in open patches among shrubs, 23 & 26 Mar. 1984, *Davidse, Herrera Ch. & Warner 25876* (CR, ISC, LE, MEXU, MO, US). LIMON–PUNTARENAS BORDER: Cordillera

de Talamanca, Cerro Kasir, on the continental divide, 2,950 m, 9°12′N, 83°03′W, small marshy páramo in forest opening, 20 Sep. 1984, *Davidse & Herrera Ch. 29405* (CR, F, MO). PANAMA. BOCAS DEL TORO: Cordillera de Talamanca, 4 airline km NW of the main peak of Cerro Fábrega along the NW ridge of the massif, 3,000–3,150 m, 9°09′N, 82°54′W, lowest páramo slopes with low-forested gullies, in open páramo, stems purple, *Davidse et al. 25390* (MO); Cordillera de Talamanca, 2 airline km NW of the main peak of Cerro Fábrega along the NW ridge of the massif, 3,150–3,200 m, páramo with low-forested gullies, around small pond, culms and spikelets dark purple, 7–8 Mar. 1984, *Davidse et al. 25354* (CR, K, MO, PMA).

This species belongs to subgenus *Festuca* sect. *Festuca*. It appears to be related to *F. willdenowia* in that the leaf blades are not permanently convolute. It differs from that species in sclerenchyma girders associated with all vascular bundles (rather than only 2), lemma essentially glabrous and unawned (not scabrous and awned 0.5–2 mm).

Festuca herrerae is so far known only from the two peaks of the Cordillera de Talamanca that straddle the Costa Rican–Panamanian border and which form the highest part of the International Park La Amistad. Its range overlaps that of *F. talamacensis* in the Cerro Kámuk páramos.

The species is named in honor of the expert Costa Rican field botanist and plant collector, Gerardo Herrera Chacón, a good friend and co-collector of this species.

Festuca talamancensis Davidse, sp. nov. TYPE: Costa Rica. San José–Cartago: Cordillera de Talamanca, Cerros Cuericí, Parque Nacional Chirripó, continental divide, 9°35′N, 83°38′W, *Chusquea-Hypericum*-ericad shrub páramo with open areas with tussock grasses (dominated by *Cortaderia*) near the summit, 3,200–3,394 m, inflorescences nodding, 17 Sep. 1983, *G. Davidse 24776* (holotype, MO; isotypes, AAU, BM, COL, EAP, ISC, K, L, LE, MEXU, NY, PMA, PRE, SI, US, USM, VEN). Figure 1E, F.

Gramen perenne caespitosa innovationibus extravaginalibus. Culmi 45–90 cm longi. Vaginae foliorum glabrae integrae; ligula 0.4–1 mm longa; laminae foliorum 10–30 cm longae, 0.5–0.7 mm latae, involutae, infra glabrae, supra scaberullae. Panicula 10–14 cm longa, 3–4 cm lata, laxa. Spiculae 6.4–7 mm longae; gluma infra 3.4–4.5 mm longa, 1-nervia; gluma supra 4.8–6 mm longa, 3-nervia; flosculi 3; lemmata 5–6 mm longa, 5-nervia, glabra vel scaberulla, arista 0.3–1 mm longis; antherae 3, 1.1–1.4 mm longae; ovarium glabrum.

Densely caespitose, perennial herb; innovations extravaginal; rhizomes not elongated. Culms 45–90 cm long, hollow, glabrous; elongated internodes 2(3). Sheaths glabrous, stramineous, nonfibrous, the margins free; auricles absent; ligule 0.4–1 mm long, ciliolate, membranous, the lateral extensions unequal, the larger extension 1–1.5 mm long; blades 10–30 cm long, 0.5–0.7 mm wide, involute, glabrous below, scaberulous above; abaxial sclerenchyma girders well developed, sometimes limited to sclerenchyma strands below the marginal vascular bundles; adaxial sclerenchyma absent. Panicle 10–14 cm long, 3–4 cm wide, nodding, lax; axis glabrous; lowest branches 4–6 cm long, paired, ascending or the ends arching; pedicels glabrous. Spikelets 6.4–7 mm long; lower glume 3.4–4.5 mm long, subulate, 1-nerved; upper glume 4.8–6 mm long, lanceolate, 3-nerved, abaxially glabrous, adaxially scaberulous; florets 3, the lower 2 bisexual, the upper rudimentary; lemmas 5–6 mm long, obscurely 5-nerved, abaxially scabrous in the lower ¼–½, scaberulous to nearly glabrous in the upper ½–¾, adaxially scaberulous throughout, entire, the awn 0.3–1 mm long; paleas 0.5–1.5 mm shorter than the lemmas, relatively longer in the uppermost florets, densely scabrous on and between the keels, the tip slightly notched, the margins glabrous on the lower ½–¾, scabrous in the upper ¼–½; stamens 3, the anthers 1.1–1.4 mm long; ovary glabrous; styles 2, terminal, separate, long-plumose in the upper ⅘. Caryopsis 2.8–3.5 mm long, 0.7–0.8 mm wide, dark brown, glabrous, convex on the embryo side, deeply and broadly grooved on the hilum side; embryo ⅕ as long as the caryopsis; hilum ca. ⅗ as long as the caryopsis.

Paratypes. COSTA RICA. LIMON: Cordillera de Talamanca, Atlantic slope, Kámuk massif, páramo NE of the main Kámuk peak, 9°16′–17′N, 83°00′–02′W, *Blechnum*-shrub association in *Chusquea-Hypericum* páramo, 17–18 Sep. 1984, *Davidse & Herrera Ch. 29335* (BM, CR, ISC, MEXU, MO, US).

Festuca talamancensis belongs to subgenus *Festuca* sect. *Festuca*. It is closely related to *F. tolucensis* Kunth, a species distributed from Jalisco and Veracruz, México, south to Costa Rica, but *F. talamancensis* differs in its leaves glabrous abaxially (not scabrous), florets 3 (not 4–8), pedicels and inflorescence axis glabrous (not scaberulous), lower glume 3.4–4.5 mm (not 4.8–8.2 mm), upper glume 4.8–6 mm (not 6.4–9.5 mm), lemmas 5–6 mm and less strongly scabrous (not 6.5–9.5 mm), anthers 1.1–1.4 mm (not 3.2–4.2 mm). The abaxial cuticle is thicker than the epidermal cells, which are quite thick-walled. The adaxial ribs are prominent.

So far it is known only in Costa Rica from the Cordillera de Talamanca (after which it is named) in páramos associated with the two highest peaks in the country, Chirripó Grande (and its western extension Cerros Cuericí) and Cerro Kámuk. Its distribution overlaps with that of *F. tolucensis* in the Chirripó páramos.

ERAGROSTIDEAE

Sporobolus distichivaginatus R. Pohl, sp. nov. TYPE: Guatemala. Petén: Dolores, en orillando Río Machaquilla, lado sur este de caserio, fruto amarillo, en foresta alta, 18 Feb. 1971, *R. Tún Ortíz 1610* (holotype, ISC; isotypes, F, US). Figure 2.

Gramen annuum 35–50 longum. Vaginae foliorum valde distichae; laminae 2–3.5 mm latae, papilloso-ciliatae. Panicula 5–7 cm longa, 2–3 cm lata, cilindrico-pyramidalis; rami 0.5–1.5 cm longi, verticillati. Spiculae 2.8–3.4 longae; gluma inferna 1.2–1.8 mm longa; lemma 2.5–2.7 mm longum; palea findens ubi maturum; stamina 3. Utriculus 1.5–1.6 mm longus, 0.5–0.6 latus, valde complanatus.

Caespitose annual herb. Culms 35–50 cm tall, erect, unbranched, glabrous, the internodes solid. Leaves mostly basal; sheaths keeled, densely overlapping, distichous; ligule 0.1–0.2 mm long, a ciliate rim; basal blades 5–10 cm long, 2–3.5 mm wide, folded to involute toward the apex, blunt-tipped, glabrous except for basal and marginal pustulose-based elongate hairs; cauline blades ca. 2 mm, much reduced. Panicle 5–7 cm long, 2–3 cm wide, open, cylindrical-pyramidal; rachis exposed; branches 0.5–1.5 cm long, verticillate, spreading, somewhat stiff, spikelet-bearing on the outer ½; pedicels 0.2–0.6 mm long, appressed. Spikelets 2.8–3.4 mm long, brown; glumes, lemma, and palea membranous; lower glume 1.2–1.8 mm long, narrowly lanceolate, acuminate, 1-nerved, the margins frequently becoming inrolled; upper glume 2.9–3.4 mm, lanceolate, acute, 1-nerved; floret solitary; lemma 2.5–2.7 mm, lanceolate, 1-nerved; palea nearly as long as the lemma, 2-nerved, splitting as the fruit matures; flower bisexual; lodicules 2, glabrous, truncate to emarginate; stamens 3, the anthers 1–1.2 mm, yellow; stigmas 2, separate; styles plumose, white. Utricle 1.5–1.6 mm long, 0.5–0.6 mm wide, somewhat oblong in side view, strongly flattened in cross section, apically broadly rounded; pericarp gelatinous when moistened; embryo ca. ⅖ as long as the utricle.

Paratype. GUATEMALA. PETEN: La Cumbre, in Chacte Abajo, bordering the river, 15 Feb. 1971, *Contreras 10529* (MO).

This species is closely related to *Sporobolus erectus* A. Hitchc. but differs by its apparently annual (vs. perennial) habit, the more strongly distichous leaf sheaths (the basis of the epithet), and smaller inflorescences (5–7 × 2–3 cm vs. 13–17 × 5–7 cm).

Sporobolus distichivaginatus is so far known only from river margins below 500 m in the Petén, Guatemala. *Sporobolus erectus* is known from pine-oak forests in Chiapas, Oaxaca, and Veracruz, Mexico, at elevations ranging from 1,200 to 2,300 m.

PANICEAE

Eriochloa stevensii Davidse, sp. nov. TYPE: Nicaragua. Granada: 31 km NW of Río Ochomogo bridge along Hwy. 1, ca. 11°40′N, 85°59′W, ca. 60 m, level *Crescentia* savanna, common, erect, inflorescence whitish green, 20 Aug. 1981, *W. D. Stevens & O. M. Montiel 20608* (holotype, MO; isotypes, BRI, CR, HNMN, ISC, K, MEXU, SI, US). Figure 3A–F.

Gramen annuum 50–100 cm longum. Folia, culmi, rami inflorescentiae et pedicelli dense velutini. Panicula 14–25 cm longa, 2–5 cm lata; racemi 17–57, 1–3.5 cm longi. Spiculae 3.4–5.5 mm longae, plerumque binatae, lanceolatae, acuminatae vel aristatae ad 1.0 mm, pilosae adpressae infernae ¾; flosculus superus 1.9–2.3 mm longus, 0.8–1.0 mm latus, ellipticus, apiculo vel arista 0.1–0.2(–0.4) mm longo.

Annual herb. Culms 50–100 cm tall, erect, densely velvety pubescent; internodes hollow. Leaves mostly cauline, densely velvety pubescent in all parts; sheaths somewhat keeled toward the apex; ligule with the membrane 0.1–0.2 mm long and cilia 0.5–1.0 mm long; blades 10–21 cm long, 4–14 mm wide, linear, flat. Inflorescence 14–25 cm long, 2–5 cm wide, a panicle of simple racemes or the racemes rarely with a short branch bearing solitary spikelets in large specimens; racemes 17–57, 1–3.5 cm long, ascending, the rachis 0.4–0.5 mm wide; main rachis, rachis of racemes, and pedicels densely velvety pubescent; pedicels 0.3–1.0(–2.0) mm. Spikelets 3.4–5.5 mm long, 1.2 mm wide, paired, solitary toward the apex of a raceme, ascending, lanceolate; basal callus 0.2–0.3 mm long; upper glume 3.4–5.2 mm, acuminate or aristate for 1.0 mm, lanceolate, 3-nerved, appressed pilose in the lower ¾; lower floret sterile; lower lemma as long as to 1.0 mm shorter than the upper glume, lanceolate, 3-nerved, appressed pilose in lower ⅔–¾, acuminate; lower palea absent; upper floret 1.9–2.3 mm long, 0.8–1.0 mm wide, minutely papillose, elliptic, glabrous except puberulent at the apex on the apiculum, obtuse, apiculate or rarely short aristate to 0.2(–0.4) mm; lodicules 2, truncate; stamens 3, the anthers 1.1–1.3 mm, yellow; stigmas 2, the styles plumose. Caryopsis 1.1–1.2 mm long, ca. 0.7 mm wide, broadly elliptic, ± flattened on both the hilum and embryo sides; hilum ca. ⅓ as long as the caryopsis, narrowly elliptic; embryo slightly over ⅓ as long as the caryopsis.

Paratypes. NICARAGUA. RIO SAN JUAN: 0.5 km S of Río Oyote, bridge on road to San Miguelito, 11°43′N, 84°58′W, 40 m, 28 Aug. 1983, *Nee & Miller 27604*

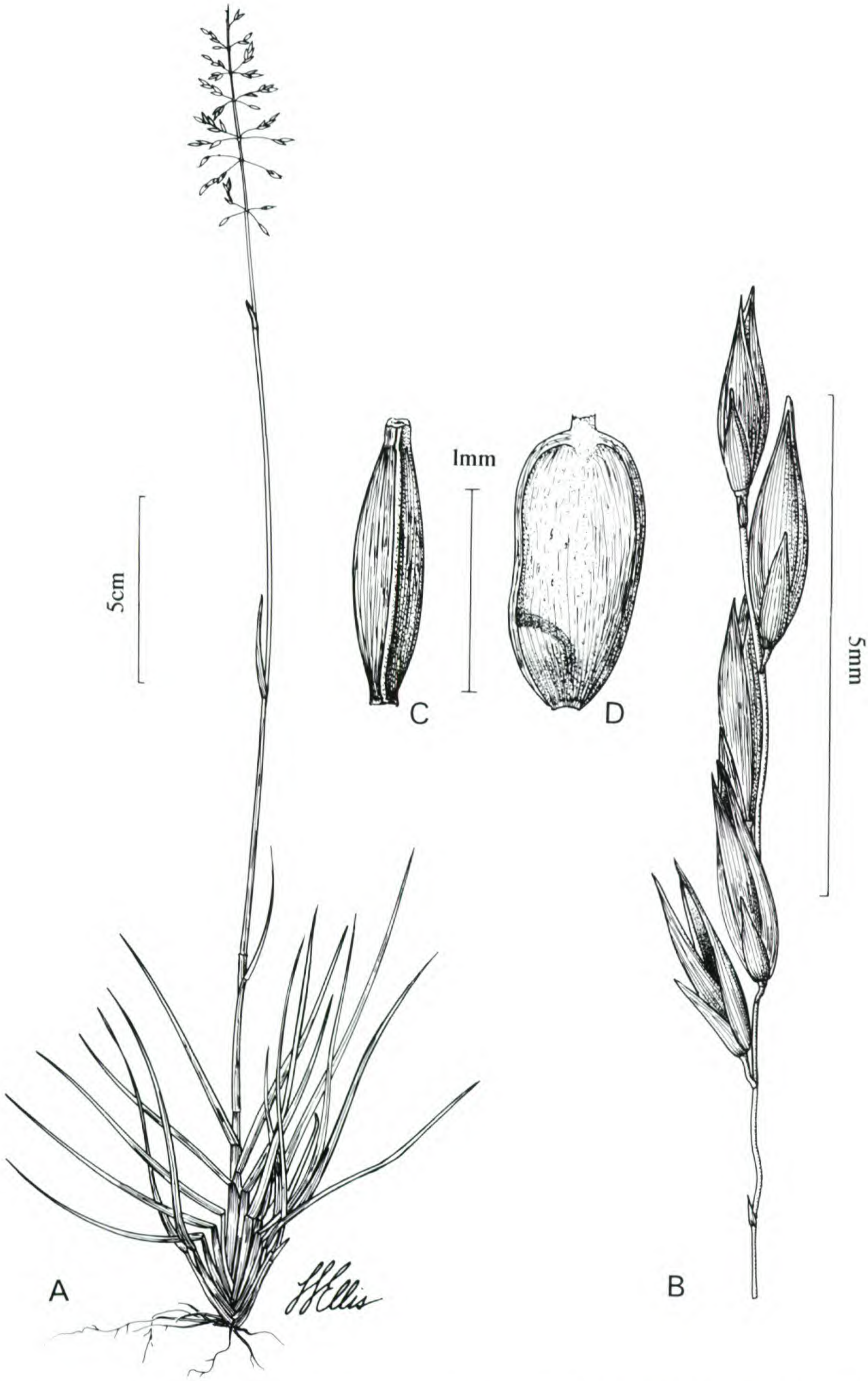

Figure 2. *Sporobolus distichivaginatus* R. Pohl. —A. Habit. —B. Panicle branch with spikelets. C, D. Utricle. —C. End view. —D. Side view. (A, B based on *Contreras 10529:* C, D based on *Tún Ortíz 1610.*)

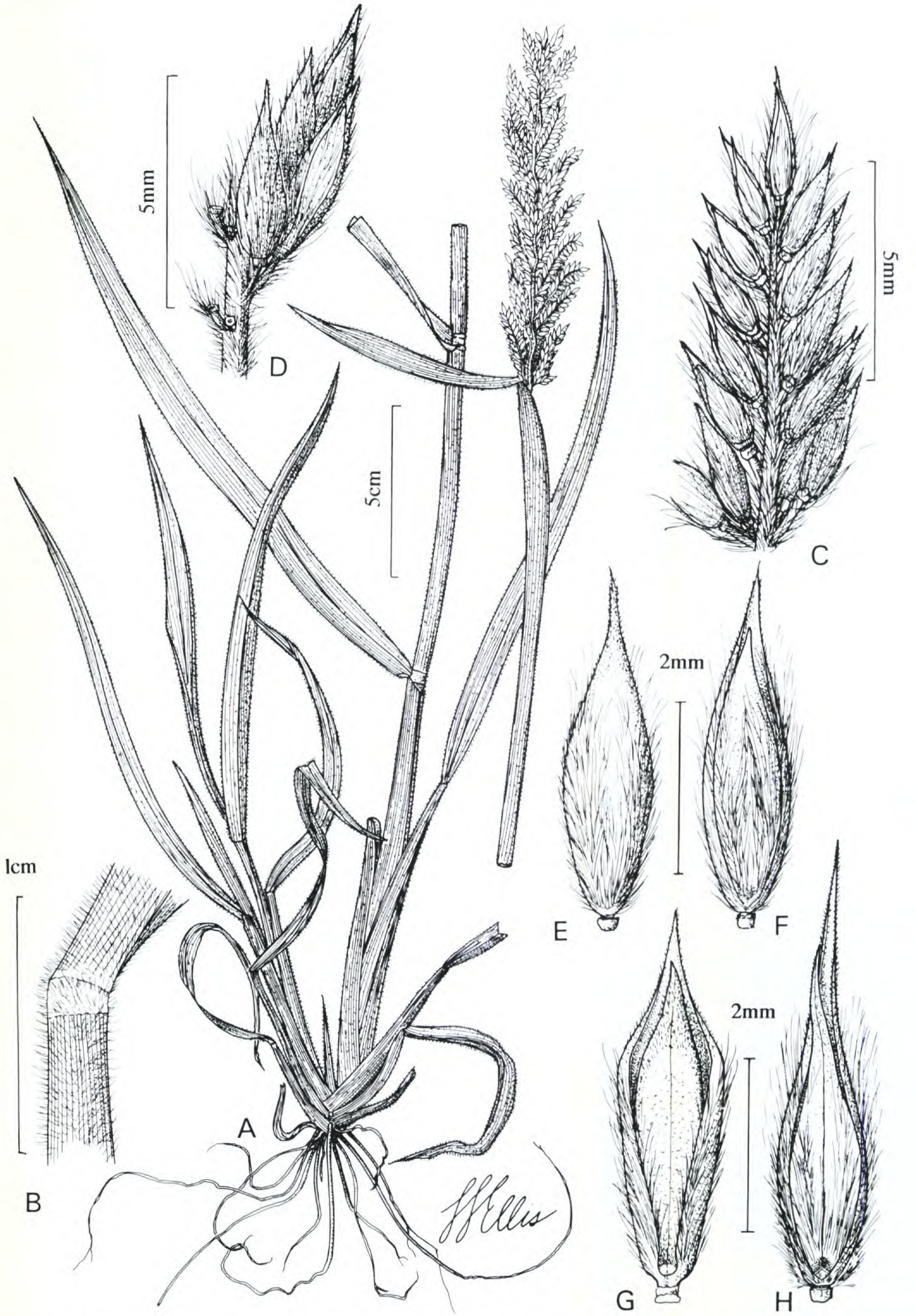

Figure 3. *Eriochloa* species. A–F. *E. stevensii* Davidse. —A. Habitat. —B. Portion of leaf in the ligular area illustrating the velvety pubescence. —C. Raceme with spikelets. —D. Portion of raceme with two spikelet pairs. E, F. Spikelets. —E. Dorsal view. —F. Ventral view. —G. *E. eggersii* A. Hitchc., ventral view of spikelet. —H. *E. pacifica* Mez, ventral view of spikelet. (A–F based on *Stevens & Montiel 20608;* G based on *Sagástegui 2930;* H based on *Asplund 5738.*)

(BM, CANB, ISC, MO, VEN). GRANADA: 36 km ENE of Managua, 18 Sep. 1976, *Danin 76-4-15* (MO). CHINANDEGA: Coriato, ca. 0 m, 10 Nov. 1911, *Hitchcock 8749* (US). VENEZUELA. GUARICO: Carretera Dos Caminos–El Sombrero, ca. 10 km, 17 Sep. 1981, *Trujillo & Correa 17823* (MO). ECUADOR. Puna, Ostküste, 5 m, 13 June 1934, *Schimpf 1184* (MO, US). GUAYAS: Sabanilla, 25–30 m, 12 Apr. 1951, *Solís 20594* (US); Capeira, km 21 Guayaquil to Daule, 20–200 m, 16 Mar. 1982, *Dodson & Dodson 13003* (MO, SEL). PERU. TUMBES: Prov. Zarumilla, Dtto. Matapalo, Bosque Nacional de Tumbes cerca de Campo Verde, along road to Tutumo, ca. 20 km from Tumbes, 600–800 m, 26 Apr. 1969, *Simpson & Schunke V. 833* (US).

This species has often been misidentified as *Eriochloa pacifica* Mez or sometimes as *E. eggersii* A. Hitchc., closely related annual species from Ecuador and Peru. Both of these species are similar to *E. stevensii* in having densely velvety pubescent inflorescence branches, paired spikelets, and a similar ligule.

Eriochloa pacifica (Fig. 3H) is a more delicate plant with fewer (4–17 vs. 17–57), more appressed racemes, relatively wider and shorter leaf blades that are glabrous to pubescent (but not densely velvety), modally larger spikelets (5.0–7.3 mm vs. 3.4–5.5 mm) with longer (1.0–3.0 mm vs. to 1.0 mm) awns, and pedicels with noticeably elongated trichomes toward the apex versus more or less the same length.

Eriochloa eggersii (Fig. 3G) is morphologically more variable than *E. pacifica* or *E. stevensii*. It also tends to have fewer racemes (usually fewer than 15), but some plants may rarely have as many 24. The leaf blades are similar to *E. pacifica* in tending to be relatively shorter and broader and generally less pubescent. Compared to *E. stevensii*, *E. eggersii* has longer spikelets (5.5–8.1 mm vs. 3.4–5.2 mm), the upper glume is widest at about or above the middle (vs. below the middle) and strongly clasped and enrolled over the lower lemma, the awn of the upper floret is longer (0.3–1.0 mm vs. 0.1–0.2 mm), and the tip of the upper glume is frequently bidentate (vs. entire at the apex) in at least some spikelets of a raceme. However, this may be limited to a single indentation on one side only, and the glume margins may be entire in other spikelets of the racemes.

Shaw & Webster (1987) treated *Hitchcock 8749* collected in Nicaragua as part of *E. pacifica* and considered it adventive in Nicaragua. However, it is probably native in Nicaragua, and is another example of the well-known distribution pattern exhibited by species of the dry, deciduous forest zone along the Pacific side of Mesoamerica that reoccur in Ecuador and continue on into Peru (Gentry, 1982). What is more surprising in this case is its occurrence on the eastern side of the Andes in Venezuela, although it occupies a similar vegetation type in the savannas of the Venezuelan llanos. In Nicaragua it is found in the dark, heavy clays typical of the *Crescentia* savannas.

The callus sometimes has a very narrowly triangular free lower glume up to 1.1 mm long.

The species is named in honor of Warren Douglas Stevens, Director of Research of the Missouri Botanical Garden and collector of the type collection, in recognition of his outstanding contributions to our knowledge of the Nicaraguan flora.

Acknowledgments. Davidse is grateful to the National Geographic Society for financial support, which enabled him to explore remote areas of the Cordillera de Talamanca in Costa Rica and Panama. We thank Linda S. Ellis for the illustrations.

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Podocarpus acuminatus (Podocarpaceae), a New Species from South America

David J. deLaubenfels
Department of Geography, Syracuse University, Syracuse, New York 13244-1160, U.S.A.

ABSTRACT. A new species, *Podocarpus acuminatus*, from southern Venezuela and nearby Brazil is described.

A new species of *Podocarpus* was recognized in material recently collected in South America.

Podocarpus acuminatus de Laubenfels, sp. nov.
TYPE: Brazil. Amazonas: Serra da Neblina, *Farney 870* (holotype, MO).

Folia linearia vel ovata, ca. 3–4 cm longa, 8 mm lata, acuminata, plus minusve revoluta; juvenilia 10 cm × 13 mm. Gemma globularis; squamae cuspidatae, 4–6 mm longae. Tegmina carnosa ovata seminorum crista prominenti, 1 mm longa, praedita; receptaculum 3 bracteis obtectum.

Small tree 4–5 m tall. Leaves linear to ovate, ca. 3–4 cm long × 8 mm wide, acuminate, slightly revolute; juvenile leaves to 10 cm × 13 mm. Foliage buds globular; bud scales erect, cuspidate, 4–6 mm long. Fleshy covering of the seed with a prominent apical crest 1 mm long; receptacle with at least three bracts: with one seed a third, smaller bract occurs below the usual sterile bract, with two seeds one or more smaller bracts occur between the two fertile bracts. Pollen structures unknown.

Distribution. Grows as an exposed tree in cloud forests and among rocks, at 1,900–2,400 m.

Acuminate leaves are uncommon in *Podocarpus*, and there are no examples among closely related species, all of which occur in South America, with acuminate leaves anywhere near the size of those of *P. acuminatus*. Among other Venezuelan species of *Podocarpus* (see deLaubenfels, 1982), *P. magnifolius* is the only closely related one with acuminate leaves, and it is noted for its large leaves more than 18 mm wide. Similar-sized leaves occur in *P. buchholzii* and *P. brasiliensis*, where the acute to blunt leaves show no signs of an acuminate apex (deLaubenfels, 1982). The extra sterile bracts on the fertile structures are unusual and have not previously been observed on any South American species. The prominent crest helps to differentiate *P. acuminatus* from the other South American species with similar-sized leaves. Short, erect, cuspidate bud scales are also distinctive.

Paratypes. VENEZUELA. AMAZONAS: Sierra de la Neblina, *Nee 30743* (MO). BOLIVAR: Chimantá, SW Amurí-tepui, *Huber 11408* (MO).

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A New Species of *Brongniartia* (Fabaceae: Faboideae) from Guerrero, Mexico

Oscar Dorado

Rancho Santa Ana Botanic Garden, Claremont, California 91711, U.S.A. and
Universidad Autónoma del Estado de Morelos, Ave. Universidad 1001,
Cuernavaca, Morelos, Mexico 62210

Jaime Bonilla and Armando Burgos

Universidad Autónoma del Estado de Morelos, Cuernavaca

ABSTRACT. A new species, *Brongniartia zirandarensis* (Fabaceae: Faboideae), from Guerrero, Mexico, is described and illustrated. Its affinities to *B. mollicula* Brandegee are discussed, and data are provided on habitat and abundance.

RESUMEN. Se describe y se ilustra una especie nueva, *Brongniartia zirandarensis* (Fabaceae: Faboideae), del estado de Guerrero, México. Se discuten sus afinidades con *B. mollicula* Brandegee y se proporcionan datos de su hábitat y abundancia.

Brongniartia is a neotropical genus nearly endemic to Mexico. Of the approximately 60 species from this genus, only two, *B. minutifolia* S. Watson (southern Texas) and *B. ulbrichiana* Harms (Bolivia), are found outside of this country. The Río Balsas Basin in southern Mexico is an important center of diversification for the genus. The state of Guerrero, with most of its territory included in this region, contains about ten species known from the genus; four of these are endemic to the state. Two new species were recently described from Guerrero, one endemic, *B. guerrerensis* (Jiménez & Contreras, 1989), and the other distributed on the Río Balsas Basin, *B. montalvoana* (Dorado & Arias, 1992). During a systematic study of the Podalyrioides group of *Brongniartia* (Dorado, 1988), some specimens were collected in northern Guerrero that did not correspond with any of the previously known taxa. These collections are proposed here as representing a new species.

Brongniartia zirandarensis O. Dorado, J. Bonilla & A. Burgos, sp. nov. TYPE: Mexico. Guerrero: Mpio. Zirándaro, "El Mirador," 17.6 mi. W of Zirándaro on dirt road to El Tamarindo, 2 Sep. 1991, *O. Dorado, J. Bonilla & A. Burgos 2145* (holotype, MEXU; isotypes, ENCB, HUMO, MO, RSA, XAL). Figure 1.

Brongniartia molliculae maxime similis, sed differt ramis juvenibus glabratis, stipulis reniformibus versus ramorum basem, 8 vel pluribus foliis in ramis juvenibus, 17–21 foliolis per folium, bracteolis 2–3 mm longis, et calyce 0.9–1.3 cm longo.

Small shrub to 1.5 m tall, with grayish bark, the younger branches yellowish green and glabrous. Stipules (0.7–)1–2.3 cm long, (0.4–)1–2.2 cm wide, texture foliaceous or slightly coriaceous in older branches, glabrate or sparsely pilose, obliquely ovate or elliptic at end of branches and reniform at base of branches, persistent, venation conspicuous, especially at the upper surface, lower lobe present and forming a (5°–)35° to 80°(–90°) angle, with a cordate base, upper lobe present and forming a 90° to 135° angle, the edge of the stipule adjacent to the petiole excurvate, apex obtuse to rounded. Leaves 7.5–11(–17.5) cm long, glabrate; petiole 0.9–1.7 cm long, terete, glabrate; rachis 8.2–13(–14.7) cm long, glabrate, with 17–21 opposite or subopposite leaflets; stipels 0.6–0.8 mm long, commonly absent; leaflets 1.4–2.4(–2.8) cm long, 0.6–1.6(–1.8) cm wide, petiolule 1–2 mm long, glabrate, lamina elliptic or sometimes obovate, texture rather thin, glabrate, base acute or sometimes rounded, apex acute to rounded, with a mucro 0.5–1 mm long. Flowers borne solitary at the base of leaf-bearing nodes; peduncles (0.8–)1.3–2 cm long, erect, glabrate; bracteoles 2–3 mm long, 0.2–0.3 mm wide, yellowish, subulate, normally persistent, opposite, with some whitish hairs along the margin; calyx 0.9–1.3 cm long, 0.4–0.6 mm wide, sparsely pilose, campanulate, two vexilar lobes 7–8 mm long, 4.5–5 mm wide (both lobes), connate ⅔ of their length; lateral lobes 5.5–7 mm long, 2.5–3 mm wide, carinal lobe 6–7 mm long, 2–2.5 mm wide; standard 1.3–1.5 cm long, 2–2.3 cm wide, red, reflexed ca. 90°, widely obovate and becoming narrower at the base, slightly auriculate, the apex cleft to 2 mm, claw 4–4.5 mm long, 2–3 mm wide, strongly curved; wing petals 1.7–1.8 cm long, 0.65–0.7 cm wide,

Figure 1. *Brongniartia zirandarensis* O. Dorado et al. (from *O. Dorado et al. 2145*). —a. Branch with flower and fruit. —b. Standard, front view. —c. Standard, face view. —d. Wing petal. —e. Keel petal. —f. Gynoecium. Scale bar = 2 cm in a; 1 cm in b–f.

obliquely oblanceolate, red, claw 2–2.5 mm long, about 1 mm wide; keel petals 1.7–1.8 cm long, 0.9–0.95 mm wide, pinkish, lunate, the ventral face straight, claw 2.5–3 mm long, about 1 mm wide, auricula of the keel forming a 95°–110° angle with the claw; androecium 2.1–2.2 cm long, anthers 1.8–2 mm long; ovary about 0.7 cm long, glabrous, with an obconical staminal sheath 0.9–1.1 mm long at the base of the ovary, with 3–5 ovules, style 1.5 cm long, glabrous, sometimes slightly exserted from the keel. Fruit 4.3–5 cm long, 1.7–1.9 cm wide, oblanceolate, rather sessile, mucro about 3.5 mm long, usually with 3–5 seeds (only immature seeds known).

Paratypes. MEXICO. GUERRERO: Mpio. Zirándaro, "El Mirador," 17.6 mi. W of Zirándaro on dirt road to El Tamarindo, 15 Dec. 1991, *J. Bonilla, A. Burgos & J. Viana 2134* (HUMO, MEXU, MO, RSA).

Brongniartia zirandarensis is most similar to *B. mollicula* Brandegee, a species distributed in southern Mexico, in the states of Puebla and Oaxaca. Both species share several morphological features, such as the presence of thin leaflets, short stipels (inconspicuous in most cases), presence of short, leafless, flowering branches (more commonly absent, the flowers then occurring at leaf-bearing nodes), and red to maroon flowers. However, the two species can be distinguished by several morphological characters. The leaves of *Brongniartia zirandarensis* bear 17–21 leaflets; the young branches are glabrous and bear 8 or more leaves with reniform stipules; the bracteoles are 2–3 mm long and the calyx is 0.9–1.3 cm long. Conversely, the leaves of *B. mollicula* bear 5–13 leaflets; the young branches are pubescent and bear fewer than 6 leaves, these with obliquely ovate stipules; the bracteoles are 0.2–0.6 mm long, and the calyx is (1.2–)1.4–1.7 cm long.

Brongniartia zirandarensis is known only from the type locality in tropical deciduous forest at 240 m. The dominant trees are *Acacia* spp., *Bursera* spp., *Caesalpinia pulcherrima* (L.) Sw., *Lysiloma tergemina* Benth., *Pithecellobium dulce* (Roxb.) Benth., *Jacquinia pungens* A. Gray, and *Cordia elaeagnoides* DC. The first collections of this species were made from about ten individuals growing on disturbed edges of a road cut. In a second search for more populations (*J. Bonilla et al. 2134*), fewer individuals were encountered. This was apparently due to recent road widening activity. Although the rarity of *B. zirandarensis* may be explained by the lack of explorations in the area, the low number of individuals suggests that this species may be one of the rarest of *Brongniartia*.

The specific epithet is derived from the nearby town of Zirándaro and pays homage to the friendly, helpful residents of that town.

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New Species of Woody Plants from Amazonian Peru

Alwyn H. Gentry
Missouri Botanical Garden, P.O. Box 299, St. Louis, Missouri 63166, U.S.A.

ABSTRACT. New species of *Ancistrothyrsus* (Passifloraceae), *Spathelia* (Rutaceae), and *Allophylus* (Sapindaceae) from Amazonian Peru (and adjacent regions) are described and discussed. In addition, a new combination is made to elevate *Allophylus pilosus* to specific rank.

Miscellaneous new species from Amazonian Peru have accumulated in my files over the past decade. Unpublished names for some of these species have been used in the herbarium, but formal publication has been hitherto postponed in hopes of obtaining additional material or more complete field observations. The names are now needed for inclusion in the *Catalogue of the Flowering Plants and Gymnosperms of Peru* (Brako & Zarucchi, in prep.).

PASSIFLORACEAE

Ancistrothyrsus hirtellus A. Gentry, sp. nov. TYPE: Venezuela. Amazonas: trail S from Cerro Neblina base camp on Río Mawarinuma, from clear water stream to top of first small hills, 150–350 m, 0°50′N, 66°11′W, 3 May 1984 (fr), *Gentry & Stein 47114* (holotype, MO; isotypes, AAU, HUA, MO, NY, VEN). Figure 1.

Frutex scandens, ramulis hirtellis. Folia lamina obovata vel oblongo-elliptica, 7–24 cm longa, 3.5–12 cm lata, infra dense hirtella, supra sparsim hirtella. Inflorescentia axillaris, in cirrhum desinens, ramulis fertilibus lateralibus. Flores albi, sepalis lanceolatis dense puberulis, petalis lanceolatis ca. 2.5 cm longis, staminibus ovarioque in androgynophoro portatis. Capsula 4-valvata, dense puberula.

Canopy liana, the branchlets terete, persistently hirtellous with somewhat crisped trichomes, with axillary tendrils having thickened curved tips. Leaves with blade obovate to oblong-elliptic, rounded at apex, broadly cuneate to rounded at base, 7–24 cm long, 3.5–12 cm wide, densely and persistently hirtellous with erect or suberect trichomes below, also with scattered peltate scales, above conspicuously peltate-lepidote with reddish scales and sparsely hirtellous over surface and more persistently along main veins, the petiole 0.8–1 cm long, adaxially grooved, rather densely pubescent with subappressed-rufescent trichomes, arising from a conspicuously raised projection from the branchlet. Inflorescence axillary, the short fertile branches borne laterally near a hooked or coiled apical tendril, the peduncle reddish hirtellous, 4–13 cm long. Flowers white, the sepals lanceolate or lanceolate-elliptic, acute, densely tannish puberulous, ca. 3 cm long, 7–8 mm wide, persistent in fruit, the petals lanceolate, ca. 2.5 cm long, the ovary and gynophore encircled by a corona formed from a ring of filamentous staminodia basally fused and densely pubescent, the stamens with filaments arising from base of ovary at apex of ca. 4-mm-long androgynophore, at least 6 mm long (anthers and filament apex eaten in only mature flowers examined), the anthers in bud 1.5–2 mm long, dorsifixed, not apiculate, the ovary ovoid, densely villous, topped by four slender style branches. Capsule yellow at maturity, 4-valved, ellipsoid, acute at apex, conspicuously stipitate at base, 6–9 cm long, 3.5–4 cm wide, the stipe 1–2 cm long, densely tannish puberulous with both short crisped hairs and longer suberect ones as well as numerous reddish peltate glands, the valves woody but fragile, ca. 3 mm thick, pulp completely lacking, the seeds 12–14 mm long, 1 mm wide, borne 2–5 together along the midline of each valve, flattened and obovate with a shallowly pitted surface, not arillate.

Distribution. Poor soil terra firme areas of central and northwestern Amazonia, below 200 m.

Paratypes. VENEZUELA. AMAZONAS: Cerro Neblina base camp, Río Mawarinuma, 0°50′N, 66°11′W, mature forest on sandy "ultisol" and along clear water stream, 140 m, 2 May 1984, *Gentry & Stein 47103* (MO, VEN). PERU. LORETO: Prov. Loreto, Dept. Tigre, Río Corrientes, Shiviyacu, camino a Forestales (38 km), 25 Nov. 1979 (fl, fr), *Ayala 2334* (AMAZ, MO). BRAZIL. AMAZONAS: Estrada do Rais, silva secundaria non inundabili, 23 Nov. 1936 (fl), *Ducke 290* (NY); Igarapé do Binda, terra firme, solo argiloso, mata virgem, *Rodrigues & Chagas 4074* (*INPA 10639*) (NY).

This species is not uncommon in the vicinity of the Cerro Neblina base camp, as judged by fallen fruits in three different places along the limited trail system explored. All plants were canopy lianas growing in tangles of other lianas in the top of a canopy tree and invisible from the ground. We were only able to locate the leaves and attached fruits of the

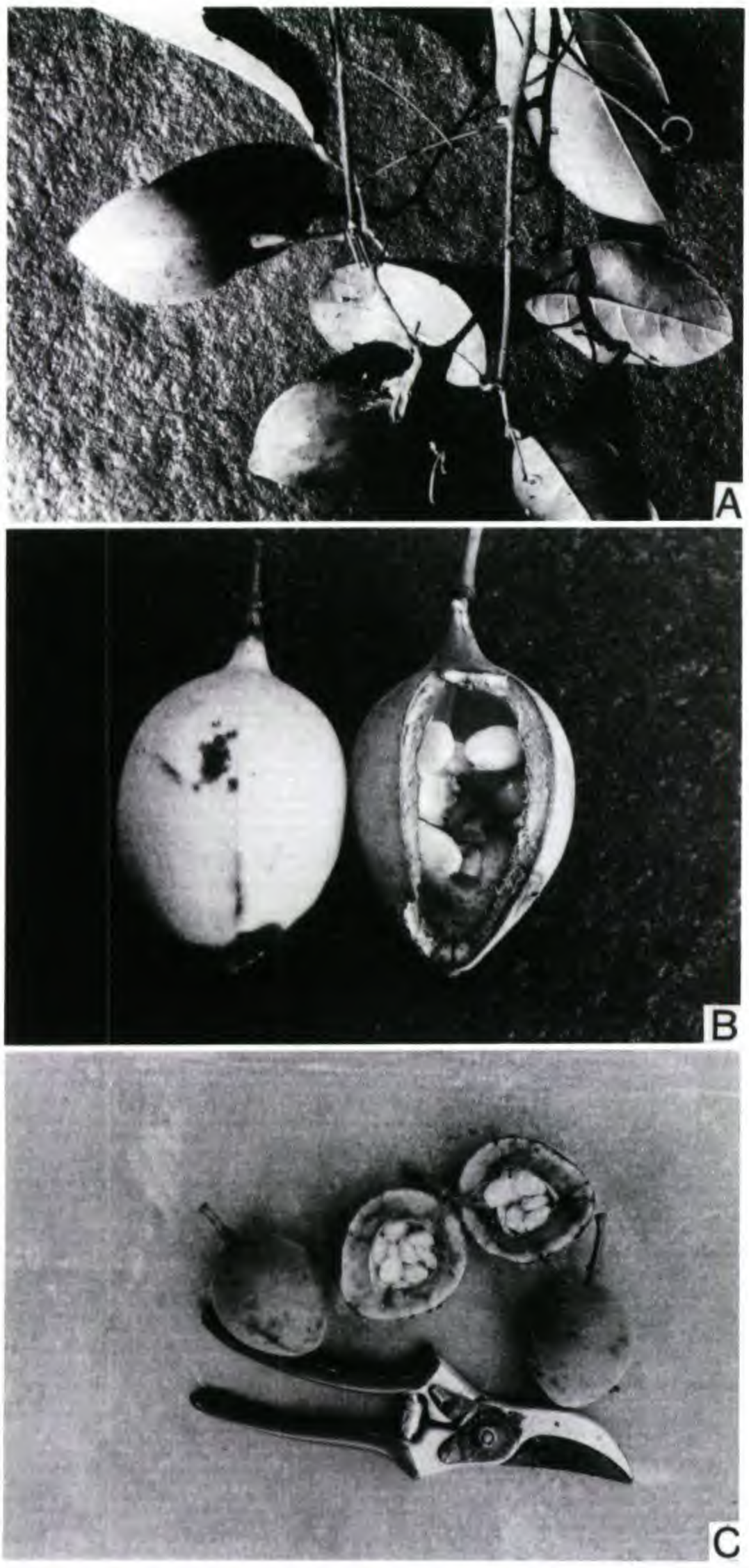

Figure 1. *Ancistrothyrsus* fruits. A, B. *A. hirtellus* (*Gentry & Stein 47114*). —A. Habit. —B. Fruit, close up. —C. *A. tessmannii* (*Gentry et al. 55911*, from Indiana, Loreto, Peru). Shears are 21 cm long.

type, recognized in the field as a new species, after climbing several nearby trees.

The hitherto monotypic genus *Ancistrothyrsus* Harms, previously known only from a few collections from Peru and Brazil, is of unusual phylogenetic and phytogeographic interest. *Ancistrothyrsus* is the only neotropical representative of the otherwise palaeotropical, mostly African, tribe Paropsieae, with features intermediate between Flacourtiaceae and Passifloraceae (DeWilde, 1971). Moreover, *Ancistrothyrsus* is the only climbing member of Paropsieae, and is closer to Passifloraceae sensu stricto, with which it shares such unusual characters as tendril-bearing inflorescences, than is any other member of Paropsieae. *Ancistrothyrsus* was described in Flacourtiaceae and is retained under that family in most herbaria and in the *Flora of Peru* (Macbride, 1941), although modern African floristic authors (e.g., DeWilde, 1975; Fernandes & Fernandes, 1978) generally treat the tribe Paropsieae under Passifloraceae. DeWilde (1971) has shown convincingly that *Ancistrothrysus*, too, is best treated under that family, a conclusion accepted by Keating (1973) and Sleumer (1980).

Examined Peruvian material of *A. tessmannii* Harms (including an isotype, *Tessmann 4479* (NY)), differs conspicuously from the plant described above in having the mature leaves uniformly glabrous, except for the lepidote glands. Juvenile leaves have short, appressed hairs different in form from the much longer, erect ones of *A. hirtellus.*

The mature fruit of *A. tessmannii* (and thus of the genus) has never been described. Harms (1931) merely noted in the original description that juvenile fruits are subglobose and densely hirsute. The mature fruit is globose or depressed-globose, 4–9 cm long, 4–8 cm in diameter, densely and finely tannish puberulous, with the pericarp 3–4 mm thick. The seeds are flattened-obovoid, 1–1.5 cm long, and 0.9–1 cm wide. Thus the fruit of *A. tessmannii* is quite different from that described here for *A. hirtellus*, which differs in being much narrower and more ellipsoid with a more acute apex, a longer basal stipe, and more strongly tomentose valves. There is no doubt that these very different fruits belong to different species.

Interpretation of the limited available floral material is more problematic. DeWilde (1971) studied three collections, one in fruit and two in flower. He emphasized that the two flowering collections, *Ducke 24385* and *35681* (neither of which I have examined), had very different flowers, differing in flower size and in apiculate versus nonapiculate anthers. The large-flowered specimen (*Ducke 24385*) had tepals ca. 4 cm long and nonapiculate anthers; the small-flowered specimen (*Ducke 35681*) had tepals less than 2 cm long and long-apiculate anthers. It would be tempting to suppose that these two flower morphs correlate with the two different species recognized here, except that a single stamen of the two flowers of *Klug 650* and *Ducke 639* each has a long, conspicuous apicule, while the remainder of the stamens of these flowers are nonapiculate.

DeWilde gave no indication of what other features correlate with his two flower types. However, since both the glabrous-leaved collections here referred to *A. tessmannii* and the pubescent-leaved ones referred to *A. hirtellus* have large tepals, flower size

may not be a useful differentiating character. One of the collections cited above, *Rodrigues & Chaves 4074*, is not included in the description of *A. hirtellus*. It is dramatically different from all other material examined in the 3–4-mm-long trichomes that are interspersed with the normal reddish hirtellous ones on its branchlets. These long trichomes have short, reddish lateral branches and resemble miniature bottle-brushes. The examined duplicate of the Rodrigues collection has only buds, but if *Ducke 35681*, the small-flowered specimen with apiculate anthers illustrated by DeWilde, should prove to share this unusual pubescence, these two collections would merit specific recognition.

The two *Ancistrothyrsus* species are apparently allopatric, but they are rarely collected and their geographical distributions are not entirely clear. All but one of the thirteen Peruvian *Ancistrothyrsus* collections examined belong to *A. tessmannii*, including material from Loreto, Amazonas, and San Martín departments. Both species also occur in Brazil: *Ducke 639* (MO, NY), from São Paulo de Olivença near the Colombian border, is typical glabrous-leaved *A. tessmannii*, but *Ducke 290* (NY), from near Manaus, is *A. hirtellus*. One of the specimens illustrated by DeWilde (1971) (*Ducke 24384*, provenance not indicated) has ellipsoid stipitate fruits and hirtellous branchlets and would seem referrable to *A. hirtellus*. Since the two flowering collections examined by DeWilde had very different floral morphologies, it is possible that his two flower morphs correspond to the two different species of *Ancistrothyrsus*. Apparently, *A. hirtellus* is restricted to the poor soil area of central and northwest Amazonia, while *A. tessmannii* occurs in the lateritic soil areas of the Solimoes and Peruvian Amazonia. In the Iquitos area I have seen *A. tessmannii* only in mature forests on relatively fertile soils.

RUTACEAE

Spathelia terminalioides A. Gentry, sp. nov. TYPE: Peru. Loreto: Mishana, Río Nanay halfway between Iquitos and Santa Maria de Nanay, 140 m, mature forest on upland white sand near Campamento Uno, 73°30′W, 3°50′S, 25 Feb. 1981 (fl, fr), *Gentry et al. 31751* (holotype, MO; isotypes, AMAZ, USM). Figure 2.

Arbor eramosa. Folia pinnata, rhachidi in quoque latere foliolos 14–39 vel ultra gerenti, foliolis alternis, oblongo-lanceolatis, acutis, 2–19 cm longis, 0.6–4 cm latis, glabratis. Inflorescentia terminalis, late paniculata. Flores feminei albi, sepalis ovatis 1 mm longis puberulis, petalis ellipticis 3–4 mm longis, staminodiis 1.5–2 mm longis filamentis alatis, ovario complanato orbiculato. Fructus planus, 2-alatus, transverse oblongus, 1.4–2 cm longus, 3–4 cm latus.

Tree ca. 30 m, unbranched, slender, with a terminal cluster of large pinnate leaves surrounding the large paniculate terminal inflorescence. Leaves multifoliolate (14–39+ leaflets (or leaflet scars) per side), the leaflets alternate, entire, oblong-lanceolate, asymmetrically obtuse at base, acute at apex, 2–19 cm long, 0.6–4 cm wide, with scattered glandular punctations, glabrous except for minute trichomes on the petiole and petiolules, at base of midvein above, and very sparsely scattered over lower surface when young, the petiole slightly flattened to strongly grooved above, flattened at base (the enlarged petiole base to at least 3.5 cm across) and forming conspicuous ridges on stem. Inflorescence large, openly paniculate, minutely puberulous, the bracts virtually absent, mostly reduced to tiny triangular flaps of tissue, the pedicels slender, minutely puberulous, 3–7 mm long. Flowers (only female seen) white, the sepals ovate, obtuse, ca. 1 mm long and wide, somewhat puberulous; petals elliptic, 3–4 mm long, rounded at tip, glabrous, staminodes 1.5–2 mm long, flat and incurved, the basal part of filaments strongly winged, the wing bilobed at tip, villous adaxially; pistil with the ovary flattened and orbicular, ca. 3 mm long, glabrous except the puberulous, thickened, 1-mm-long basal gynophore, the stigma sessile. Fruit flat, broadly 2-winged, transversely oblong and much broader than long, 1.4–2 cm long, 3–4 cm wide (narrower and rhombic when immature before the wings have expanded), glabrous, the central seed-bearing portion somewhat swollen, completely surrounded by the wing, heart-shaped if with 2 seeds or tear-drop-shaped if with one.

Distribution. Known only from the type collection from an ecologically distinctive area of white sand forest on the Río Nanay near Iquitos, Peru.

This wing-fruited genus is not typical of Rutaceae, and at first I thought the Peruvian plant might represent a new genus of Sapindaceae. Instead, this tree turns out to belong to a mostly West Indian genus otherwise known in South America only from the Guayana Shield area and central Amazonia. Most of the South American species are locally endemic, small trees of the tepui summits (Cowan & Brizicky, 1960).

Most of the West Indian species are quite different from *Spathelia terminalioides*, with narrower, 3-winged, fruits, while the Guayana Highland material I examined is similarly 2-winged but with wings that are thicker and less developed. There is also a single lowland Amazonian species, *S. excelsa*

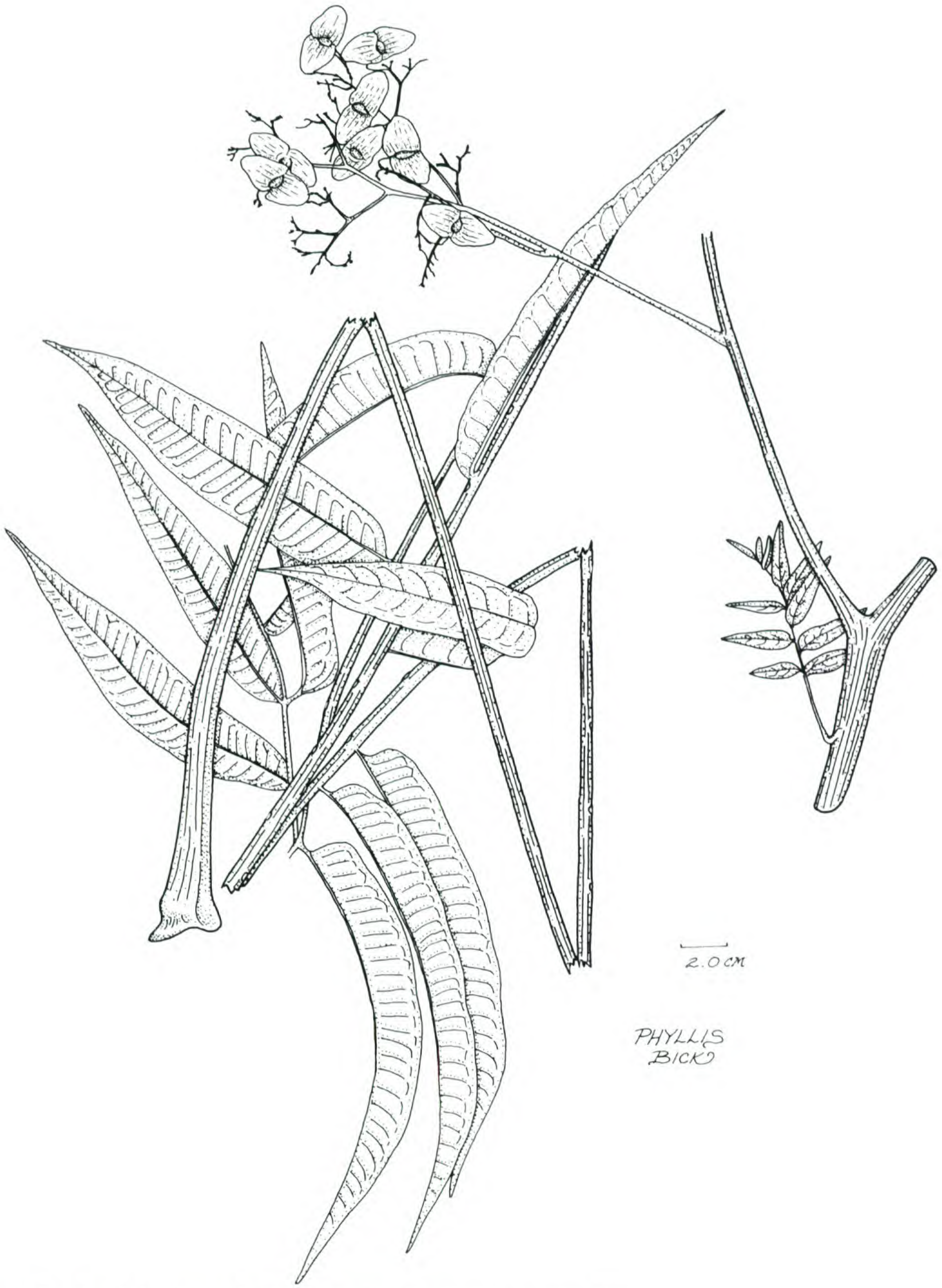

Figure 2. *Spathelia terminalioides* A. Gentry (*Gentry et al. 31751*, MO).

(K. Krause) R. Cowan & Briz., which is the nearest relative of the Peruvian species. That species is known only from a few collections from central Amazonian Brazil (Albuquerque, 1977). *Spathelia excelsa* differs from *S. terminalioides* in having a tannish villous inflorescence and in larger (2.5–3.5 × 4.5–6 cm) fruits with differently shaped wings. The fruit wings of *S. terminalioides* are somewhat triangular in outline, with relatively narrow tips and a straight ventral margin, while *S. excelsa* has more

rounded wing apices and a prominently cordate ventral margin. The fruits of *S. terminalioides* are similar in form to those of such *Terminalia* species as *T. obovata* (Ruíz & Pavón) Steudel, hence the specific epithet.

The area in which *S. terminalioides* was discovered has white sand soil and many disjuncts from the upper Río Negro area, where similar soils predominate. Thus the discovery of a Guayana genus halfway across South America from its previously known range is perhaps not as surprising as it might seem at first.

SAPINDACEAE

Allophylus multicostatus A. Gentry, sp. nov. TYPE: Peru. Amazonas: Aintami Creek, Río Cenepa, 550 ft., 24 Nov. 1972 (fl), *Berlin 346* (holotype, MO; duplicates distributed as *A. divaricatus* Radlk.).

Arbor 5–15 m alta. Folia 3-foliolata, foliolis ellipticis vel obovato-ellipticis, plus minusve serrulatis, puberulis praecipue secus venas. Inflorescentia axillaris, pyramido-paniculata, tomentosa, pedicellis minus quam 1 mm longis. Flores ca. 1 mm longi, plus minusve albi, sepalis suborbiculatis, puberulis, petalis ca. 1 mm longis, staminibus fertilibus 6–7, exsertis. Fructus ellipsoideus vel globosus, 8–9 mm longus, 7–9 mm latus, sparsim puberulus.

Tree 5–15 m tall, with sparsely puberulous and reddish punctate branchlets. Leaves 3-foliolate, the leaflets with blade elliptic to obovate-elliptic, acute to short-acuminate, broadly cuneate to obtuse at base, 7–25 cm long, 3.5–12 cm wide, firmly membranaceous, the margin serrulate to shallowly serrate or essentially entire, sparsely puberulous mostly along veins below and along midvein above, with 12–23 secondary veins on a side, these rather straight and parallel, the petiole 3.5–12 cm long, sparsely to conspicuously tannish tomentose. Inflorescence axillary, openly pyramidal-paniculate with at least the lowermost of the generally 5–9 primary lateral branches several-branched, tannish tomentose in flower, partially glabrescent in fruit, mostly over 15 cm long; pedicels < 1 mm long. Flowers ca. 1 mm long, whitish to greenish, the suborbicular sepals somewhat appressed-puberulous, the petals ca. 1 mm long, glabrous except the inconspicuously ciliate margins, the 6–7 fertile stamens exserted almost 1 mm beyond perianth, the anthers short. Fruits broadly ellipsoid to globose, greenish yellow (mature?), ca. 8–9 mm long, 7–9 mm diam., sparsely and inconspicuously appressed-puberulous.

Distribution. Lowland Amazonian Peru (and probably adjacent Ecuador).

Paratypes. PERU. AMAZONAS: Río Cenepa region, *Berlin 309, 346, Tunqui 204, Kayap 115, Huashikat 1473* (all MO).

Local names. "Suhi knum" (*Berlin 309, 346*), "tsanignum" (*Tunqui 204*), "jimagma" (*Kayap 115:* probably confused with sympatric *A. floribundus*, for which this name is usually used), "wayu" (*Huashikat 1473*).

The most noteworthy features of this plant are its large, open, much-branched panicles and the relatively close together and straight secondary venation of its usually large and dark-drying leaflets. Following Radlkofer (1900, 1932), this species keys to *Allophylus paniculatus* because of the well-developed paniculate inflorescence with branched lateral branches, but it differs from that species in the puberulous tomentum of twigs, leaves, and inflorescence. If the inflorescence is taken as merely 3–6-branched, *A. multicostatus* keys to *A. divaricatus* and *A. cinnamomeus*. In addition to the unbranched inflorescence branches, *A. divaricatus* differs from *A. multicostatus* in densely and conspicuously tannish-puberulous petioles and leaf undersides (especially the main veins), and in having generally more membranaceous leaflets with the terminal one tapering gradually to the base and distinctly differing in shape from the smaller laterals; *A. cinnamomeus* differs in its smaller, sharply serrulate leaflets and much larger (3 mm wide) flowers.

Using the *Flora of Peru* (Macbride, 1956), *Allophylus multicostatus* keys to *A. divaricatus* because of its 3-foliolate leaves and laxly branched inflorescence. However, the usually larger leaves distinguish *A. multicostatus* from that species; large-leaved specimens have the largest leaflets of any Peruvian *Allophylus*. The smaller (maximum 9 cm wide) leaves of *A. divaricatus* also dry a different color (± olive below vs. brownish to blackish brown in *A. multicostatus*) and mostly have fewer secondary veins (10–13(–15) vs. 12–23). Another difference is in the fruits; the only fruiting collection I have examined of *A. divaricatus* has smaller, densely puberulous fruits, which are very different from the large, glabrescent ones of *A. multicostatus*.

The only neotropical species published since Macbride (1956) are Bolivian *Allophylus steinbachii* F. Barkley and several Cuban species. I have not compared this species with the Cuban or palaeotropical taxa, which I assume are different on phytogeographic grounds.

Two collections with somewhat smaller leaves and inflorescences and entire leaflet margins are included in this circumscription and description because of the otherwise similar aspect and branching of the basal inflorescence branches.

Allophylus pilosus (J. F. Macbr.) A. Gentry, comb. et stat. nov. *Allophylus semidentatus* (Miq.) Radlk. var. *pilosus* J. F. Macbr., Field Mus. Nat. Hist., Bot. Ser. 13: 376. 1956. TYPE: Peru. San Martín: Juan Jui, Río Huallaga, 400 m, tree 6 m, flowers white, *Klug 3783* (holotype, F; isotype, MO).

Small tree 3–10 (–20) m tall with rufous pilose twigs, the trichomes 1–2 mm long. Leaves 3-foliolate, the leaflets petiolulate, obovate (terminal) or asymmetrically oblong-ellliptic (laterals), 6–30 cm long, 2.5–13 cm wide, membranaceous, the margin serrate, densely pubescent below; petiole 5–26 cm long, conspicuously rufous pilose. Inflorescence simply racemose, densely rufous pilose. Flowers ca. 2 mm across, the petals and sepals ca. 1.5 mm long. Fruits ellipsoid, pilose, 10–13 mm long, 6–10 mm wide, orange at maturity.

Additional specimens examined. ECUADOR. NAPO: near Río San Miguel, 21.2 km N of Lago Agrio, 470 m, 0°8′N, 76°50′W, (shrub, flowers in bud), *Croat 50363* (MO). PERU. AMAZONAS: Río Santiago, Quebrada Caterpiza, 200 m, 77°40′W, 3°50′S, (árbol 3 m, frutos verdes), *Tunqui 642* (MO), (árbol 4 m, frutos verdes), *Tunqui 978* (MO), (árbol 4 m, flores H-4), *Huashikat 584* (MO), *Huashikat 1657* (MO). HUANUCO: Bosque Nacional de Iparia, 1 km arriba del pueblo de Tournavista, Prov. Pachitea, 300–400 m, *J. Schunke V. 17867* (MO). LORETO: Quebrada Yanomono, Explorama tourist camp, ca. 72°48′W, 3°28′S, 120–130 m, (tree 10 m tall, 2″ D.B.H., fruits green), *Gentry et al. 27846* (AMAZ, MO), (tree 4 m, fruits orangish), *Gentry et al. 29065* (AMAZ, MO), (árbol 20 m, frutos verdes y marrones, pubescentes), *Díaz et al. 1184* (AMAZ, MO). MADRE DE DIOS: Tambopata, tropical moist forest on alluvial soil along Río Tambopata, 280 m, 12°49′S, 89°18′W, *Gentry et al. 45750* (MO). UCAYALI: Provincia Coronel Portillo, Río Abujao, Quebrada Shesha, 73°45′W, 8°20′S, *Díaz et al. 830* (AMAZ, MO).

Local name. "Tsanignum" (Aguaruna).

In his *Flora of Peru* Sapindaceae treatment, Macbride (1956) referred only one specimen to *A. semidentatus* (Miq.) Radlk., the pilose Klug specimen that he designated as the type of variety *pilosus*. Macbride noted that Standley had originally proposed the unpublished name *A. pilosus* for the Klug collection, but "since ex char. it seems too near *A. semidentatus*, I propose it myself as merely a variant . . . ."

Recent Peruvian material collected by the Flora of Peru project includes not only the above-cited 11 additional specimens of this taxon with distinctive, conspicuously rufous-pilose indumentum, but also nine collections of the real *A. semidentatus*, characterized by a short puberulous indumentum. The two taxa prove consistently distinct. In addition to the different indumentum, *A. semidentatus* has much smaller, narrower leaflets with a less pronounced reticulation of tertiary venation below, smaller, glabrous fruits, and a more slender inflorescence axis. Its leaves usually dry a different darker color both above and below than do those of *A. pilosus*, and the inflorescences tend to branch near the base, whereas those of *A. pilosus* are uniformly simple racemes.

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A New Combination in *Psiguria* (Cucurbitaceae) from Mesoamerica

Rachel Jane Hampshire
The Natural History Museum, Cromwell Road, London SW7 5BD, England

ABSTRACT. The new combination *Psiguria dunlapii* is made, and a key to the three Mesoamerican species of *Psiguria* is given.

Psiguria dunlapii (Standley) R. J. Hampshire, comb. nov. Basionym: *Anguria dunlapii* Standley, Field Mus. Publ., Bot. Ser. 4: 298. 1929. TYPE: Panama. Bocas del Toro; Farm Six, Changuinola Valley, 3 Mar. 1924, *V. C. Dunlap 490* (holotype, F not seen; isotype, F).

Jeffrey (1962) showed that the generic name *Anguria* Jacq. was illegitimate. Howard (1973) transferred three species from *Anguria* to *Psiguria*, and the name *Psiguria* is widely accepted by most authors, e.g., Wunderlin (1978), Jeffrey (1978), Condon & Gilbert (1990).

In preparing a treatment of the genus *Psiguria* for *Flora Mesoamericana*, it became clear to the author that the combination *Psiguria dunlapii* was needed. Wunderlin (1978) used the combination *P. longipedunculata* (Cogn.) Wunderlin (syn. *Anguria longipedunculata* Cogn.) in his treatment for *Flora of Panama*, including *Anguria dunlapii* as a synonym. *Psiguria dunlapii* is known only from the type, collected in Panama, while Cogniaux (1877) had described *Anguria longipedunculata* from Catemaco, in the state of Veracruz, Mexico, based on the specimen *Galeotti s.n.* (BR).

However, *Psiguria dunlapii* and *P. longipedunculata* are very different. *Psiguria dunlapii* has leaves that are markedly truncate to slightly cordate at the base, while *P. longipedunculata* leaves are cuneate to truncate. The leaf apex in *P. dunlapii* is shortly acuminate (the acumen 0.6–2 mm, slender) while *P. longipedunculata* has leaves that are long-acuminate (the acumen 7–15 mm, broad). The peduncle of *P. dunlapii* is 20–21 cm, while that of the type of *P. longipedunculata* is 37 cm. The type specimen of *P. longipedunculata* had one few-flowered inflorescence; that of *P. dunlapii* had two, one of which was badly insect-damaged. Because both were on loan from other institutions, no flowers were dissected. The type specimen of *P. dunlapii* is clearly distinct from *P. longipedunculata* and does not appear to match material of any other species of *Psiguria* with unlobed leaves. It therefore appears to be a distinct species, although a more detailed study, beyond the scope of a treatment for *Flora Mesoamericana*, might show *P. dunlapii* to be a synonym of *P. warscewiczii*.

The Galeotti collection of *Psiguria longipedunculata*, which is clearly different from *P. dunlapii*, matches material of *P. triphylla* with unlobed leaves. *Psiguria longipedunculata* should be considered a synonym of *P. triphylla*.

Wunderlin (1978) included under *Psiguria longipedunculata* a specimen from Llanuras de Santa Clara, Costa Rica (*Smith 6519*, BM, BR, K), which has a remotely dentate leaf margin and obtuse to truncate leaf base. This specimen appears different from *P. dunlapii* and, although similar to some unlobed *P. triphylla* material, it may represent a new species.

Wunderlin (1978) also included *Psiguria pedata* in his *Flora of Panama* treatment, following the report by Cogniaux (1916) of the species from Panama. As no material of *P. pedata* has been seen by the author, the species is not included in the key below. Therefore, only three species of *Psiguria* are recognized from Mesoamerica (from the Mexican states of Tabasco, Yucatan, and Chiapas to the Panama–Colombia border). A key to these species follows:

1a. Leaves simple, less than 4 cm across, the base truncate to cordate, not decurrent (Panama) ..... *P. dunlapii*
1b. Leaves trifoliolate, lobate or rarely simple, more than 4 cm across, the simple leaves cuneate and decurrent at the base (Tabasco to Panama).
  2a. Leaves thick and fleshy; calyx tube not spotted dark green ..... *P. triphylla*
  2b. Leaves membranaceous; calyx tube spotted with dark green ..... *P. warscewiczii*

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Five New Species of *Solanum* Section *Geminata* (Solanaceae) from Peru and Ecuador

Sandra Knapp
Department of Botany, The Natural History Museum, Cromwell Road, London SW7 5BD, United Kingdom

ABSTRACT. Five new species of *Solanum* sect. *Geminata* are described from Peru and Ecuador: *S. clivorum*, *S. goniocaulon*, *S. malletii*, *S. smithii*, and *S. tovarii*. Relationships within section *Geminata* are discussed, and an illustration and distribution map are provided for each species.

Solanum is one of the largest genera of flowering plants, with some 1,500–2,000 valid species. Most of these species are neotropical, with taxa occurring in all habitats throughout the tropics and subtropics. Peru and Ecuador are particularly rich in *Solanum* species, probably due to their great diversity in habitat (Weberbauer, 1945). Section *Geminata* is one of the largest of the subdivisions of the nonspiny solanums, with about 145 species, all but one of these neotropical. Species of section *Geminata* are distinguished by their small white flowers, woody habit, usually leaf-opposed inflorescences, and hard green fruits at maturity (in all except the *S. pseudocapsicum* alliance).

Solanum clivorum S. Knapp, sp. nov. TYPE: Peru. La Libertad: entre Huamachuco y Cajabamba, 3,000–3,200 m, 16 Mar. 1948, *Ferreyra 3059* (holotype, USM; isotypes, IBE, MO, US). Figure 1.

Frutex; caules dense pubescentes; sympodia difoliata geminata vel plurifoliata; folia elliptica supra glabra subtus dense dendritico-pubescentia; inflorescentiae foliis oppositae vel terminales dendriticae; corolla alba; bacca globosa in pedicello deflexo inserta; semina complanata reniformia.

Bushy *shrubs*, 2–3 m tall; young stems and leaves densely pubescent with dendritic trichomes ca. 0.5 mm long; bark of older stems reddish or green, glabrous. *Sympodial units* difoliate, geminate, or appearing plurifoliate due to rapid inflorescence growth. *Leaves* elliptic, commonly with several axillary shoots, glabrous (occasionally with scattered simple uniseriate trichomes on the lamina) and with a few dendritic trichomes along the main veins adaxially, densely pubescent with dendritic trichomes abaxially; major leaves 13–21 cm long, 6–9 cm wide, with 7–9 pairs of primary veins, these drying yellowish, the apex acute, the base acute; petiole 2–3 cm long; minor leaves differing from the majors only in size, 7–10 cm long, 3–4 cm wide, the apex acute, the base acute; petiole 1–2 cm long. *Inflorescences* opposite the leaves or appearing shoot-terminal, 3–7 cm long, many-times branched, 20–40-flowered, densely pubescent with dendritic trichomes; pedicel scars unevenly spaced 1–2 mm apart. *Buds* globose, the corolla only halfway exserted from the calyx tube. *Pedicels at anthesis* erect, tapering, 6–8 mm long, ca. 0.5 mm diam. at the base, densely pubescent with soft dendritic trichomes like those of the rest of the inflorescence. *Flowers* with the calyx tube conical, 1–1.5 mm long, the lobes deltate, 0.5–1 mm long, densely pubescent with dendritic trichomes; corolla white, 1–1.1 cm diam., lobed halfway to the base, the lobes planar at anthesis, densely pubescent on abaxial lobe surface with minute, dendritic trichomes; anthers 1.5–2 mm long, 1–1.5 mm wide, poricidal at the tips, the pores not opening to slits; free portion of the filaments ca. 0.5 mm long, the filament tube ca. 0.5 mm long, with 5 triangular projections ca. 0.5 mm long alternating with the anthers and closely investing the style; ovary glabrous; style 3–4 mm long, glabrous; stigma capitate, the surface minutely papillose. *Fruit* a globose, green berry, 1–1.2 cm diam.; fruiting pedicels woody, erect, 1.5–1.7 cm long, ca. 1.5 mm diam. at the base. *Seeds* dark reddish brown, flattened-reniform with thickened margins, 3–4 mm long, 2–2.5 mm wide, the surfaces minutely pitted.

Distribution. In the Cajabamba valley, department of Cajamarca, Peru, on steep rocky slopes from 2,000 to 2,800 m. Figure 5.

Paratypes. PERU. CAJAMARCA: Cutervo, Laguñac, camino a Cochabamba, 2,000 m, 26 Feb. 1985, *Llatas Quiroz 1178* (F); Cajabamba, Finca Zúl, 2,500 m, 22 Aug. 1985, *Mostacero L. & Guerra L. 63* (HUT, MO, NY); Cajamarca, entre Matara y Namora, 2,600 m, 16 Aug. 1973, *Sánchez Vega et al. 1217* (NY); Namora–Matara, 2,600 m, 16 Aug. 1973, *Sagástegui A. 7755* (HUT, MO, NY); Huamachuco–Cajabamba, 2,800 m, 16 Nov. 1983, *Sagástegui A. 11144* (HUT, NY).

Figure 1. *Solanum clivorum* S. Knapp (from *Ferreyra 3059*, USM). Scale bar = 1 cm.

Local name. Cajamarca: shirac.

Solanum clivorum is closely related to the common and widely distributed species *S. oblongifolium* Dunal. It differs from *S. oblongifolium* in its smaller flowers, denser pubescence, and in the projections from the filament tube. *Solanum clivorum* is unusual in section *Geminata* in not having the terminal pores of the anthers elongate to slits with age or drying. This condition is also found in *S. reitzii* and *S. pseudoquina*, two species not closely related to *S.*

Figure 2. *Solanum goniocaulon* S. Knapp (from *Young 4213*, NY). Scale bar = 1 cm.

clivorum and found in southern Brazil. The restricted range of *S. clivorum* is within the range of *S. oblongifolium*, but *S. clivorum* appears to occur in drier microhabitats.

This species is named for its habitat (clivorum—growing on slopes).

Solanum goniocaulon S. Knapp, sp. nov. TYPE: Peru. San Martín: Río Abiseo National Park, hill E of Gran Pajaten ruins, 2,350 m, ca. 7°S, 77°W, 13 Aug. 1986, *K. Young 1213* (holotype, HUT; isotypes, K, NY). Figure 2.

Frutex vel arbor; caules glabri valde quadrangulati; sympodia difoliata geminata; folia elliptica supra glabra nitida subtus glabra nitida in status sicco aurea; corolla ignota; bacca globosa glabra in pedicello deflexo inserta; semina ovoideo-reniformia.

Trees, 7 m tall; young stems and leaves minutely pubescent with golden uniseriate trichomes ca. 0.5 mm long; stems distinctly four-angled, erect; bark of older stems yellow-gray, glabrate. *Sympodial units* difoliate, geminate. *Leaves* elliptic, thick and leathery, glabrous and shiny adaxially, drying dark green, glabrous or pubescent with uniseriate golden trichomes ca. 0.5 mm long along the midrib and primary veins abaxially, drying dark gold; major leaves 15–28 cm long, 5–8 cm wide, with 8–10 pairs of primary veins, these obscure abaxially, the apex acute, the base attenuate, somewhat winged onto the petiole; petioles 1–1.5 cm long; minor leaves differing from the majors only in size, 3–10 cm long, 1.5–5 cm wide, the apex acute, the base attenuate, somewhat winged onto the petiole; petiole 0.7–1 cm long. *Inflorescence* opposite the leaves, simple, 1–

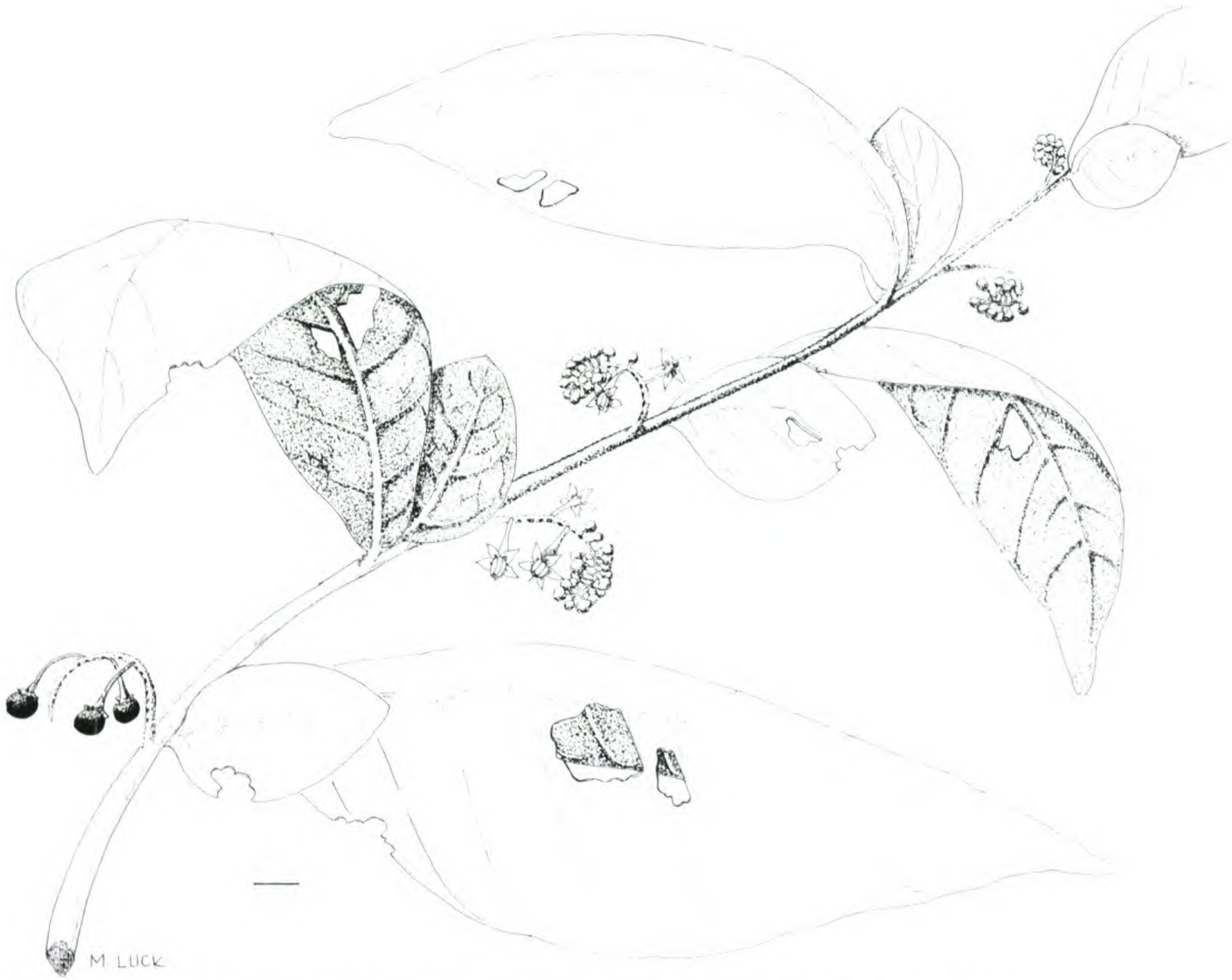

Figure 3. *Solanum malletii* S. Knapp (from *Knapp & Mallet 6564*, US). Scale bar = 1 cm.

3 cm long, sparsely puberulent at the tip, 20–30-flowered; pedicel scars beginning ca. halfway from the base, closely spaced, not overlapping. *Buds* elongate when very small, sparsely pubescent with uniseriate trichomes on the tips of the calyx lobes, larger buds not known. *Flowers* not known. *Fruit* a globose, green berry, 1–1.2 cm diam.; fruiting pedicels woody, deflexed, 2–2.2 cm long, ca. 2 mm diam. at the base. *Seeds* pale tan, ovoid-reniform, 3–4 mm long, 2.5–3 mm wide, the surfaces minutely pitted.

Distribution. In rainforest in northern Peru, Cajamarca and San Martín departments, from 2,000 to 2,500 m. Figure 5.

Paratypes. PERU. CAJAMARCA: Jaen, Río Agua Blanca near Río Jeronga, 8,000 ft., 30 July 1943, *Evinger 461* (US).

Solanum goniocaulon is a species of uncertain relationships in section *Geminata*. It is probably related to species in the *S. arboreum* species group (Knapp, 1986), a complex of glabrous species with usually erect fruiting pedicels and small white flowers. The flowers of *S. goniocaulon* are not known, but the buds (on *Evinger 461*) are similar to those of *S. anisophyllum* van Heurck & Muell.-Arg., a primary forest species of the eastern Andean slope in Peru and Ecuador. The strongly 4-winged stem and the distinctive yellow color of the undersides of dried leaves readily differentiate *S. goniocaulon* from any other species of section *Geminata*.

This species is named for its distinctly angled stems (gonio—angled; caulon—stem).

Solanum malletii S. Knapp, sp. nov. TYPE: Peru. Amazonas: Bagua, Quebrada Chinganza, 8 km N of Muyo, km 472 of Oleoducto Norperuano, 350–400 m, 5°25′S, 78°28′W, 5 July 1984, *Knapp & Mallet 6564* (holotype, USM; isotypes, BH, F, K, US). Figures 3, 4.

Frutex; caules dense pubescentes; sympodia difoliata geminata anisophylla; folia supra glabra nitida subtus dense dendritico-pubescentia; folia majora obovata minora orbiculata; inflorescentiae foliis oppositae elongatae dense pubescentes; corolla viridis lobis subtus dense pubescentia; bacca globosa pubescentia; semina complanata reniformia margine incrassata.

Figure 4. *Solanum malletii* S. Knapp (*Knapp & Mallet 6564*, Quebrada Chinganza, Depto. Amazonas, Peru).

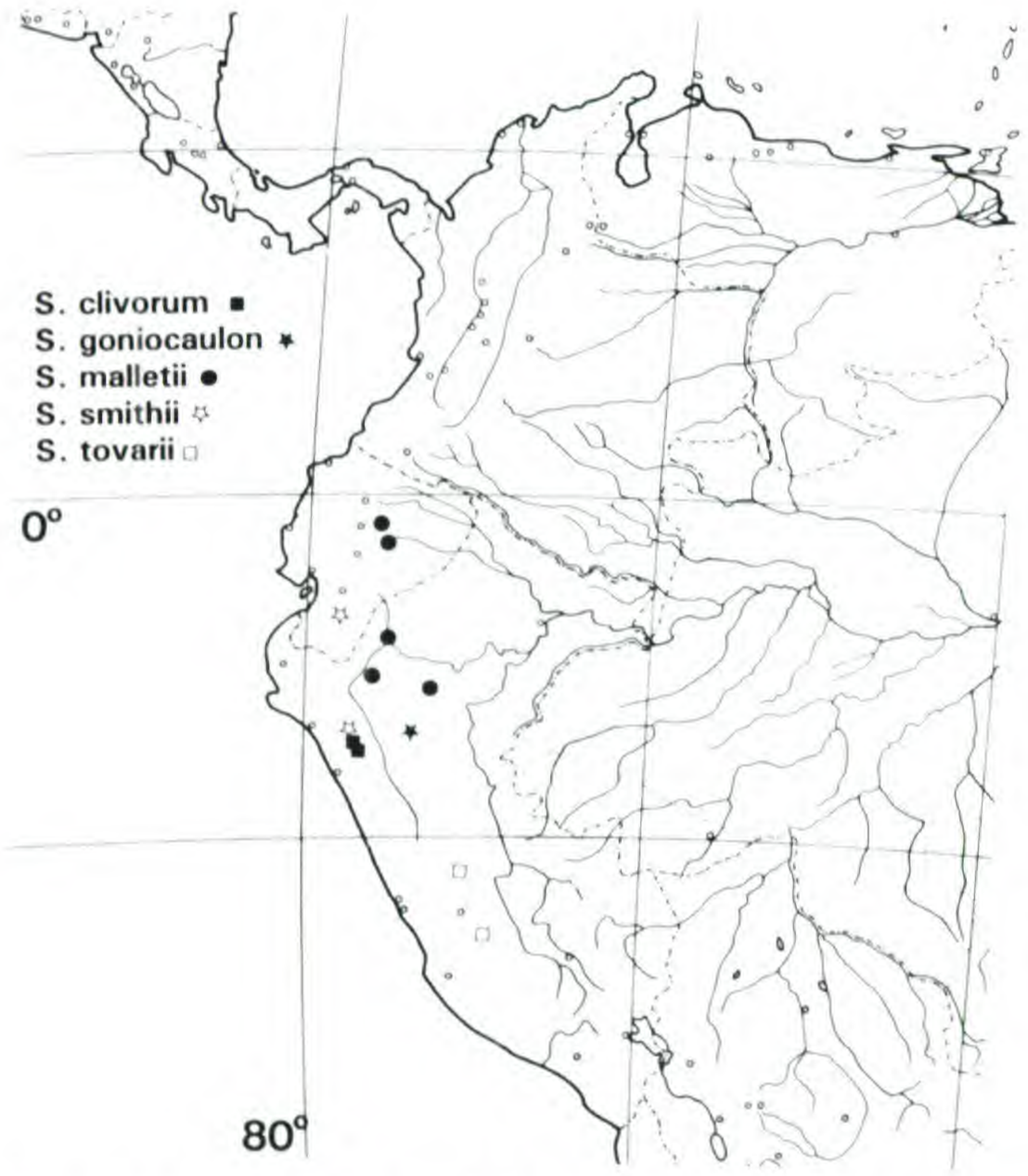

Figure 5. Distribution of *S. clivorum*, *S. goniocaulon*, *S. malletii*, *S. smithii*, and *S. tovarii*.

Slender *shrubs* to *small trees*, 1–7 m tall; young stems and leaves densely pubescent with dendritic trichomes, these 0.5–1 mm long, pale golden when dry, beige when fresh; bark of older stems reddish brown, sparsely pubescent with dendritic trichomes. *Sympodial units* difoliate, geminate, anisophyllous. *Leaves* glabrous and shining adaxially, with a few dendritic trichomes along the main veins, pubescent with dendritic trichomes abaxially, the pubescence denser along the veins; major leaves elliptic-obovate to obovate, 17–26 cm long, 8–15 cm wide, with 9–13 pairs of primary veins, the apex acute to acuminate, the base sessile and truncate, usually somewhat auriculate; petiole if present ca. 2 mm long; minor leaves differing from the majors in both size and shape, orbicular, 3–7.5 cm long, 3–7 cm wide, the apex rounded, the base rounded; petioles 1–2 mm long. *Inflorescences* opposite the leaves, simple, 1–15 cm long, 10–15-flowered, but with up to 100 scars, densely pubescent with dendritic trichomes; pedicel scars densely spaced, not overlapping. *Buds* globose, the corolla strongly exserted from the calyx tube, densely pubescent with dendritic trichomes. *Pedicels at anthesis* somewhat deflexed, strongly contracted beneath the calyx tube, ca. 1 mm diam. at the apex, 0.5 mm diam. at the base, 0.7–1 cm long, densely pubescent with dendritic trichomes like those of the rest of the inflorescence. *Flowers* with the calyx tube broadly conical, 1.5–3 mm long, the lobes triangular, 1.5–3 mm long, densely pubescent with dendritic trichomes; corolla pale green, 1–1.2 cm diam., lobed ca. ¾ of the way to the base, the lobes planar at anthesis, the abaxial surface of the lobes densely dendritic pubescent; anthers 2–2.5 mm long, 1.5–2 mm wide, in the type with a few dendritic trichomes on the abaxial surface, poricidal at the tips, the pores opening to slits with age; free portion of the filaments ca. 0.25 mm long, the filament tube ca. 0.5 mm long; ovary densely pubescent with dendritic trichomes ca. 0.5 mm long; styles heteromorphic, in short-styled flowers 1–1.5 mm long, in long-styled flowers 5–6 mm long; stigma clavate, the surface minutely papillose. *Fruit* a globose, green berry, 1–1.2 cm diam.; fruiting pedicels woody, erect or deflexed, 0.7–1 cm long, ca. 1.5 mm diam. at the base. *Seeds* reddish brown, flattened-reniform with the margins incrassate and paler, 1–3 mm long, 1.5–2.5 mm wide, the surfaces minutely pitted.

Distribution. On the western margin of the Amazon basin in Ecuador and Peru, in tropical wet forest, from 200 to 500 m. Figure 5.

Paratypes. ECUADOR. NAPO: Reserva Biológica Jatun Sacha, Río Napo, 8 km E of Misahualli, 450 m, 1°04′S, 77°36′W, 21–25 May 1987, *Cerón M. 1394* (MO, NY); Parque Nacional Yasuni, Pozo Amo 2, trochas de Amosur, 230 m, 0°52′S, 76°05′W, 9–13 Jan. 1988, *Cerón M. & Coello 3182, 3298* (MO, NY). PERU. AMAZONAS: 400 m behind La Poza, Río Santiago, 180 m, 22 Aug. 1979, *Huashikat 130* (MO). LORETO: Balsapuerto, lower Río Huallaga, 150–350 m, 28–30 Aug. 1929, *Killip & Smith 28636* (NY, US).

Solanum malletii is related to *Solanum xanthophaeum* Bitter of Peru and *Solanum microleprodes* Bitter of Central and northern South America, but differs from both those species in its almost auriculate leaf bases and pubescent fruits. *Solanum xanthophaeum* shares with *S. malletii* loose dendritic trichomes, while *S. microleprodes* has congested, echinoid trichomes (see Roe, 1971; Knapp, 1989). *Solanum malletii* is found in primary rainforest as well as secondary forest. The species appears to be andromonoecious, as many flowers in the type specimen were found to be short-styled (see Fig. 4). This breeding system is probably common in section *Geminata*, but no species have yet been tested experimentally.

This species is named in honor of James Mallet, who found the type specimen and who for many years has been a patient companion.

Solanum smithii S. Knapp, sp. nov. TYPE: Ecuador. Loja: ca. 30 km S of Catamayo on road to Cariamanga, 1,900–2,000 m, 4°10′S, 79°20′W, 6 Feb. 1984, *Knapp & Mallet 6252*

Figure 6. *Solanum smithii* S. Knapp (from *Knapp & Mallet 6252*, NY). Scale bar = 1 cm.

(holotype, NY; isotypes, AD, BH, F, G, GH, K, MEXU, MO, QCA, QCNE, US). Figure 6.

Frutex; caules glabrae; sympodia difoliata vel plurifoliata; folia elliptica coriacea supra glabra nitida subtus pubescentia trichomatibus dendriticis in axillis venarum ferentia; corolla ignota; bacca globosa alboviridis in pedicello deflexo inserta; semina ochracea ovoidea reniformia; testa foveolata.

Shrubs to 1 m; young stems and leaves glabrous to densely red papillose, the branches erect; bark of older stems dark reddish brown. *Sympodial units* difoliate or plurifoliate, not geminate, with many short shoots. *Leaves* elliptic, widest at the middle, occasionally thick and somewhat coriaceous, glabrous adaxially, pubescent with tufts of dendritic trichomes ca. 0.5 mm long in the axils of the primary veins abaxially, with 4–6 pairs of primary veins, the blades 5–14 cm long, 1.5–5.5 cm wide, the apex acute to rounded, the base attenuate, minutely winged onto the petiole; petiole 0.5–1.5 cm long. *Inflorescences* internodal or on short shoots, simple, glabrous, 1–4 cm long, 6–7-flowered; pedicel scars unevenly spaced 3–5 mm apart. *Buds* elongate and somewhat pointed, only very small buds known. *Pedicels at anthesis* not known. *Flowers* not known. *Fruit* a globose, green to greenish white berry, 1–

1.2 cm diam.; fruiting pedicels somewhat deflexed, woody, 1–1.3 cm long, 1–1.5 mm diam. at the base, 3–4 mm diam. at the apex, the calyx lobes reflexed in fruit. *Seeds* pale tan, ovoid reniform, 4–5 mm long, 3–4 mm wide, the surfaces minutely pitted.

Distribution. In dry forests and scrublands in the Huancabamba depression of northern Peru and southern Ecuador, from 1,900 to 2,600 m. Figure 5.

Paratype. PERU. CAJAMARCA: Condebamba valley, Cajabamba–Cajamarca road, 2,100–2,600 m, 7°33′S, 78°09′W, 15 Feb. 1983, *Smith & Vasquez 3409* (MO, NY, USM).

Solanum smithii is similar to *S. barbulatum* Zahlbr., also of highland Ecuador and Peru, but differs from that species in its ovoid reniform seeds and axillary tufts of dendritic trichomes. The closest relative of *S. smithii* is *S. tunariense* Kuntze of Andean Bolivia. *Solanum smithii* differs from *S. tunariense* in having trichomes confined to small tufts in the axils of the primary veins on the abaxial leaf surfaces, its somewhat larger leaves, and its longer fruiting pedicels. The flowers of *S. smithii* are not known, but from the shape of the immature buds I expect them to have elongate calyx lobes.

The leaves on the type specimen are much larger than and not as coriaceous as those on *Smith & Vasquez 3409*. The type was collected in a shady, wet quebrada, while the Peruvian collection is probably from a more open habitat.

This species is named in honor of the late D. N. Smith, an indefatiguable collector of Peruvian plants and the collector of the paratype.

Solanum tovarii S. Knapp, sp. nov. TYPE: Peru. Huancavelica: Hacienda Tocas entre Colcabamba y Paucarbamba, 3,000–3,100 m, 19 Apr. 1954, *Tovar 1932* (holotype, USM; isotype, IBE). Figure 7.

Frutex; caules dense pubescentes trichomatibus simplicibus uniseriatis; sympodia difoliata geminata; folia elliptica coriacea supra sparse subtus dense pubescentia margine revoluta; inflorescentiae foliis oppositae simplices sense pubescentes; calycis lobi quadratus; corolla alba carnosa; bacca matura et semina ignotae.

Shrubs 1–2 m tall; young stems and leaves densely pubescent with soft, uniseriate, simple (occasionally branched) trichomes 1–2 mm long; bark of older stems greenish brown, glabrate. *Sympodial units* difoliate, geminate. *Leaves* elliptic, thick and somewhat leathery with revolute margins, sparsely pubescent with uniseriate trichomes like those of the young growth adaxially, the trichomes denser along the main veins, the adaxial epidermis large-celled and crystalline, more densely pubescent with uniseriate, simple or branched trichomes abaxially; major leaves 4–8.5 cm long, 1.5–3.5 cm wide, with 7–10 pairs of primary veins, these drying yellowish, the apex acute, the base acute; petiole 0.3–1 cm long; minor leaves differing from the majors only in size, 1.5–4.5 cm long, 0.5–2.1 cm wide, the apex acute, the base acute; petiole 2–5 mm long. *Inflorescences* opposite the leaves, simple, 2–4 mm long, densely pubescent with uniseriate trichomes like those of the stems and leaves, 3–5-flowered; pedicel scars densely packed, overlapping. *Buds* globose, the corolla exserted from the calyx tube. *Pedicels at anthesis* tapering, 0.7–1 cm long, deflexed, sparsely pubescent with uniseriate, simple trichomes like those of the inflorescence, ca. 0.5 mm diam. at the base, 1 mm diam. at the apex. *Flowers* with the calyx tube broadly conical, 1.5–2.5 mm long, the lobes quadrate with minute apiculae, sparsely pubescent with simple, uniseriate trichomes, the apiculae with tufts of simple trichomes; corolla white, waxy, 1.3–1.5 cm diam., lobed ¾ of the way to the base, the lobes planar at anthesis, the tips and margins of the lobes densely papillose; anthers 4–4.5 mm long, 1.5–2 mm wide, poricidal at the tips, the pores becoming slitlike with age; free portion of the filaments ca. 0.25 mm long, the filament tube minute, often not present, glabrous; ovary sparsely pubescent with simple, uniseriate trichomes ca. 0.5 mm long; style ca. 6 mm long, pubescent at the base; stigma capitate, the surface minutely papillose. *Fruit* a globose, green berry (immature), sparsely pubescent; fruiting pedicels woody, erect, ca. 1.5 cm long. *Seeds* not known.

Distribution. In high-elevation savanna areas in the Peruvian departments of Huancavelica and Junín, from 2,700 to 3,300 m. Figure 5.

Paratypes. PERU. HUANCAVELICA: Tayacaja, Salcabamba, 3,250 m, 7 Jan. 1939, *Stork & Horton 10273* (F, K). JUNIN: Carpapata above Huacapistana, 2,700–3,200 m, 7 June 1929, *Killip & Smith 30680* (NY, US).

Solanum tovarii is superficially similar to *S. maturecalvans* Bitter (an earlier name for *S. aureifolium* Rusby), but lacks the arachnoid trichomes of that species. The trichomes of *S. tovarii* are exclusively uniseriate and can be simple or dendritic. *Solanum tovarii* is probably most closely related to *S. barbulatum* Zahlbr. of Andean Colombia to northern Peru and differs from that species in its quadrate calyx lobes, larger flowers, and in its evenly distributed abaxial leaf pubescence. In *S. tovarii* trichomes are found over the entire lower leaf surface, while

Figure 7. *Solanum tovarii* S. Knapp (from *Tovar 1932*, IBE). Scale bar = 1 cm.

in *S. barbulatum* they are generally confined to the axils of the main veins.

This species is named in honor of Oscar Tovar, Peruvian graminologist, collector of the type specimen, and a great help to botanists visiting Peru.

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of F, HUT, IBE, MO, NY, US, USM for the loan of specimens.

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Two New Species of *Cladocolea* (Loranthaceae) from Mexico and Surinam

Job Kuijt

Missouri Botanical Garden, and (mailing address) Department of Biology, University of Victoria, Victoria, V8W 2Y2, Canada

ABSTRACT. *Cladocolea racemosa* and *C. elliptica* are illustrated and described as new. The former, Mexican species is unique in the genus in having progressive indeterminate inflorescences, and highly unusual in having pedicellate flowers. The latter, Suriname species also has an indeterminate inflorescence, but is closely related to *C. micrantha*.

Since my monograph of *Cladocolea* (Loranthaceae) (Kuijt, 1975), the circumscription of the genus has changed through the publication of new entities (Kuijt, 1981, 1987a, 1987b), the removal of some to the genus *Ixocactus* (Kuijt, 1991b), and the inclusion of species from the genus *Phthirusa* (Kuijt, 1991a). I originally visualized the genus as being characterized by determinate inflorescences, though even then a few clearly derived species had inflorescences that aborted terminally; and by flowers that were arranged in monads on inflorescences and were ebracteolate.

The two new species violate both of these major generic characters: *P. racemosa* has a truly indeterminate inflorescence, and *C. elliptica* has at least some bracteolate triads at the base of an indeterminate inflorescence. In both cases, however, the alliances to the main body of *Cladocolea* seem beyond question, and these modified characters are regarded as derivative.

Cladocolea racemosa Kuijt, sp. nov. TYPE: Mexico. Guerrero: 2.5 km al WNW de Tlaxco, camino de Tototepec a San Miguel Amoltepec, bosque de pino, ladera de exposición S. colgante parasito de *Pinus*, 2,100 m, 28 Mar. 1982, *Lorea 1955* (holotype, FCME; isotypes, LEA, WIS). Figure 1.

Plantae delicatissimae, graciles, pendulae, probabiliter dioeciae, solum masculae visae. Folia usque ad 60 × 4 mm, angustissime lanceolata. Inflorescentiae staminatae axillares, singulae, indeterminatae, racemosae, prophyllis binis crassis suffultae, floribus binis, pedicellatis, ebracteolatis 10–14; bractea suffulciens cum pedicello non coalita. Flores hexameri: petala staminaque dimorpha; antherae sessiles; sacculi polliniferi 4, connectivum in cornu prominens protractum.

Extremely delicate and slender, glabrous plants, the leaf-bearing stems 1 mm or less thick, terete, sparsely branched, possibly sympodial. Leaves paired, to 6 cm long and 4 mm wide, very narrowly lanceolate, tapering into a slender petiole ca. 7 mm long, venation not evident except for the midrib, which runs into the apiculate apex. Probably dioecious, only the staminate seen. Inflorescence one per axil, indeterminate, subtended by two distinctive, thick, blunt, pink to purplish prophylls less than 0.5 mm long, and becoming at least 3–4 cm long in anthesis, racemose, bearing 10–14 paired, pedicellate flowers, the bracts 1 mm long, ovate, with rounded apex, caducous, completely free from the pedicels, which become 2.5 mm long and are deeply constricted just below the ovary in anthesis. Flower bud at least 5 mm long, one-third of which is an ovary with inconspicuous, smooth calyculus; petals 6, dimorphic, ca. 3 mm long; anthers 2 mm long, in 2 series, both series completely sessile, attached to the petal in the middle of the abaxial surface, a median ridge present below each anther; pollen sacs 4, the connective extended into a minute terminal horn; style 1.5 mm long, slender, straight, somewhat expanded just above the ovary, stigma poorly differentiated.

This is perhaps the most anomalous species of *Cladocolea*, and it could be argued that a distinct genus should be erected for it. I prefer to maintain it in *Cladocolea*, even though this placement clashes with one major element of the current circumscription of the genus. This divergent feature is the *progressive* indeterminacy of the inflorescence. There exist several other species in the genus which, technically, also have indeterminate inflorescences, but the situation is different there in that all flowers mature more or less simultaneously, e.g., *C. coriacea* Kuijt (Kuijt, 1987a); *C. cupulata* Kuijt, *C. mcvaughii* Kuijt (Kuijt, 1975); *C. biflora* Kuijt (Kuijt, 1981). Considering that the terminal flower in most *Cladocolea* species tends to be the first to mature, the simultaneous maturation of all flowers may be seen as a transitional feature to true indeterminacy. In *C. racemosa*, progressive indetermi-

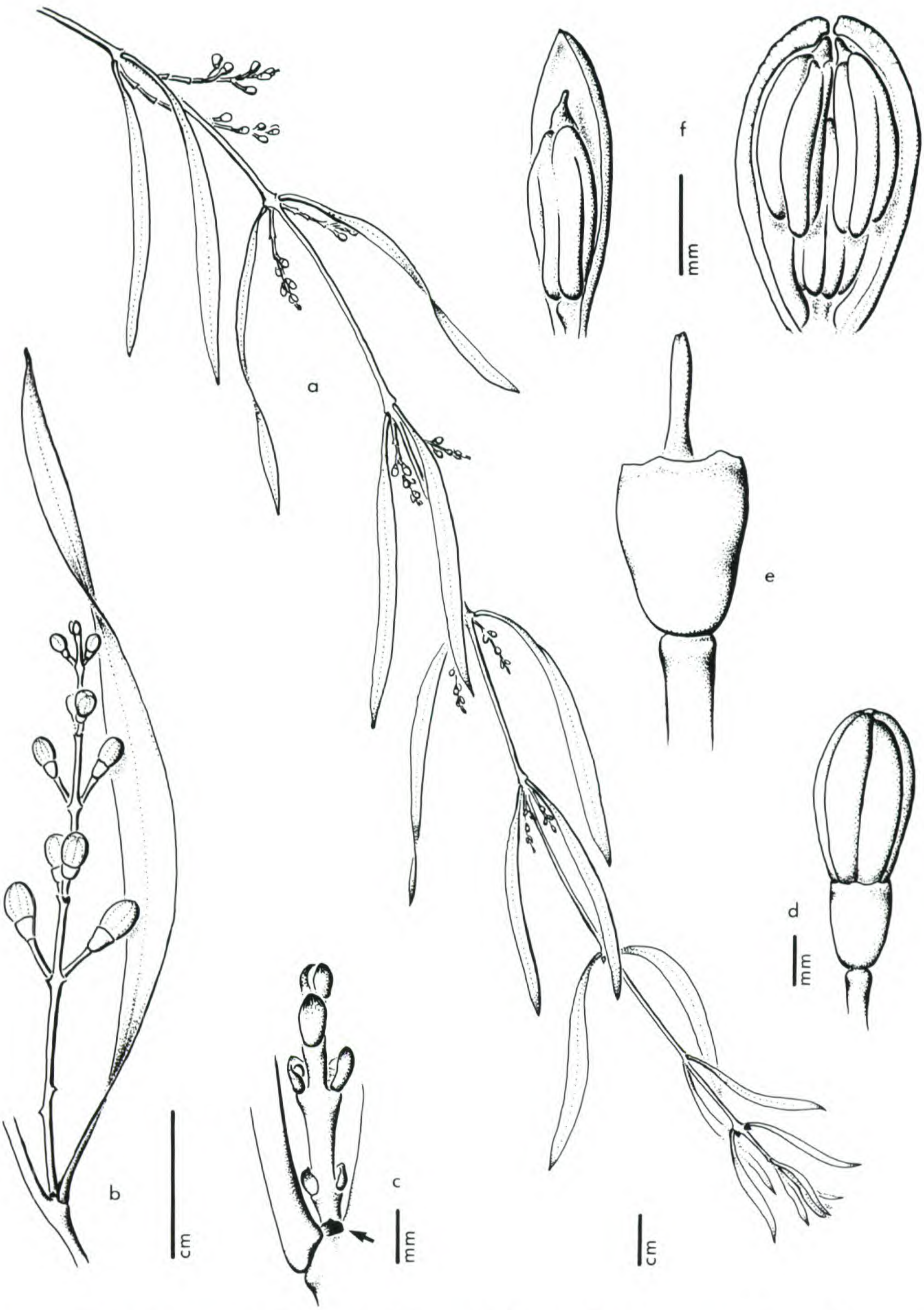

Figure 1. *Cladocolea racemosa* Kuijt. —a. Habit. —b. Mature inflorescence. —c. Young inflorescence with caducous bracts and (arrow) prophylls. —d. Mature flower bud. —e. Ovary and style. —f. Petals and anthers. (*Lorea 1955*, LEA.)

nacy is fully realized: the lowest flowers mature while the apex of the inflorescence is still forming new flowers. There is no other *Cladocolea* species for which this is true; in several related genera such as *Struthanthus*, *Oryctanthus*, *Oryctina*, and *Phthirusa*, this condition is the rule (Kuijt, 1980).

Curiously, there is entomological support for placement in *Cladocolea:* the plant bears a couple

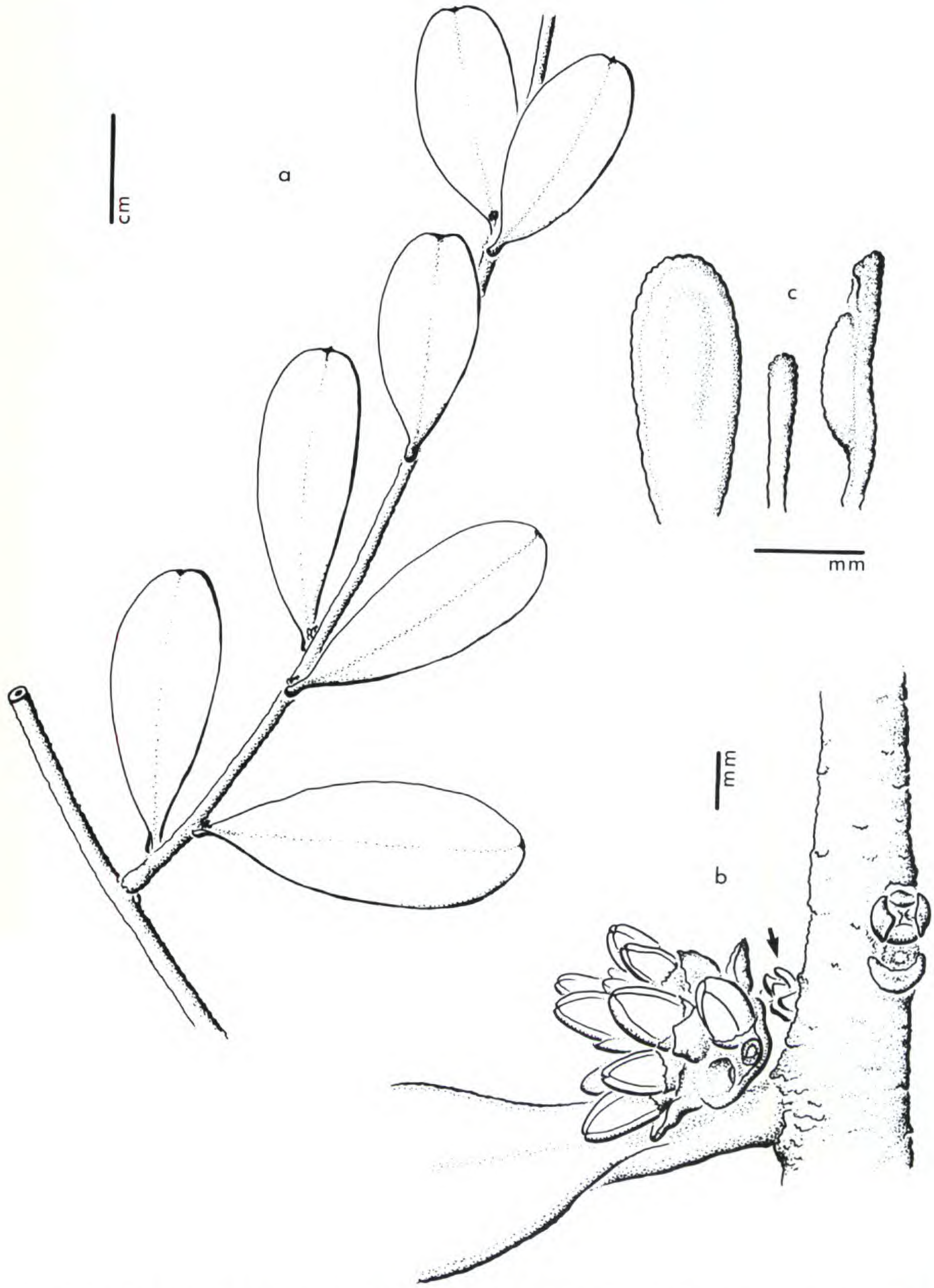

Figure 2. *Cladocolea elliptica* Kuijt. —a. Habit. —b. Mature inflorescence, with young superposed inflorescence bud (arrow). —c. Petals and style. (*Irwin et al. 57535*, P.)

of small, galled flowers exactly like those I noted years ago for a male plant of *C. loniceroides* (Kuijt, 1975, fig. 22d), also a Mexican endemic.

Two more, highly unusual features are the pedicellate flowers and the placement of their bracts directly on the inflorescence axis, rather than fused on the pedicel, thus the long pedicels are left completely free. *Cladocolea* is otherwise characterized by sessile flowers in all but *C. coriacea* Kuijt (Kuijt, 1987a), *C. harlingii* Kuijt, and *C. pedicellata* Kuijt (Kuijt, 1975). In the last two of these species, the pedicels also are free from the bracts, even though those of the lowest flowers in *C. pedicellata* are fused with the inflorescence axis, instead. None of these species appears to be closely related to *C. racemosa*. Beyond *Cladocolea*, free pedicels are rare in Loranthaceae (Kuijt, 1980), probably being limited to several New Zealand species and the median triad flowers of some American inflorescences in *Struthanthus*, *Tripodanthus*, and *Psittacanthus*.

Notwithstanding its unusual features and the large geographical distance involved, *C. racemosa* appears to have some affinity to *C. harlingii* Kuijt of southern Ecuador and northern Peru (the latter range extension is based on a recent new record from Prov. Lambayeque, Dept. Lambayeque, Procedencia Colaya, 1,400 m, *S. Llata Quiróz 2002*, LEA). That species has evolved a remarkable, leaf-mediated mode of parasitism (Kuijt, 1975), of which there is no evidence in *C. racemosa;* and its inflorescence is determinate. Other inflorescence features, however, are very similar. *Cladocolea harlingii* thus far has not been considered closely related to any other species of *Cladocolea.*

My suggestion of dioecy is based on the unusually large anthers and, conversely, the insignificant style and stigma. Neither criterion is reliable, however, and further material is needed to confirm the point. Surprisingly, the pollen is not mature in these large anthers.

Cladocolea elliptica Kuijt, sp. nov. TYPE: Suriname. Wilhelmina Gebergte, Zuid Rivier, in savanna and disturbed areas, Kayser Airstrip, 45 km above confluence with Lucie Rivier, 270 m, on shrubs 1–4 m above ground, *Irwin, Prance, Soderstrom & Holmgren 57535* (holotype, P; isotypes, BBS, NY). Figure 2.

Partes novellae leviter furfuraceae; phyllotaxis irregulariter decussata-alterna; folia usque ad 30 × 8 mm, anguste lanceolato-elliptica, apice plus minusve rotundata. Planta dioecia, typus pistillatus. Inflorescentiae minusculae (4–5 mm), sessiles, in glomerulis, quoque paribus triadum singulis vel duabus et monadis singulis vel duabus ebracteolatis, indeterminatae; apex abortivus parvus, applanatus, cuneoliformis. Flores tetrameri; petala 1 mm longa, dimorpha; flos pistillatus ut videtur antheram sterilem carens.

Plants lightly scurvy on young parts and inflorescences, phyllotaxy irregularly decussate-alternate, leaves from 4 × 1.5 cm (lower part of innovations) to 20 × 8 mm (upper part of innovations), narrowly lance-elliptic, apex rounded to mucronate-apiculate, only the lower midrib evident but venation probably pinnate; dried leaf surface strongly granular, perhaps indicating sclereid clusters in mesophyll. Dioecious, the type female. Inflorescences extremely small (4–5 mm), sessile, 1–3 per leaf axil, the 2nd and 3rd superposed slightly gray-furfuraceous, made up of 1 or 2 pairs of triads followed by 1 or 2 pairs of ebracteolate monads, indeterminate, the aborted apex forming a flat wedge between the two most distal monads. Flowers 4-merous, petals 1 mm long, dimorphic, each with oblong median cushion but apparently without sterile anther; style 0.5 mm, clavate, stigma weakly differentiated.

Cladocolea elliptica is closely related to *C. micrantha*, but very different in leaf appearance and furfuraceous surfaces of young parts and inflorescences, especially the indeterminate inflorescence. It shares with *C. micrantha* the aberrant feature of having bracteolate triads in the lower part of the inflorescence, tetramery, and a very similar general appearance.

Acknowledgments. I am indebted to Karel U. Kramer for the Latin diagnoses, and to the Natural Sciences and Engineering Research Council of Canada for continuing financial support.

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Hypnella ambrosia (Bryopsida: Hookeriaceae), a New Species from Bolivia

Marko Lewis
Herbario Nacional de Bolivia, Casilla 10077, La Paz, Bolivia

Bruce Allen
Missouri Botanical Garden, P.O. Box 299, St. Louis, Missouri 63166-0299, U.S.A.

ABSTRACT. The existence of a *Hypnella* species (*Hypnella ambrosia*, sp. nov.) with short marginal leaf cells, cells with walls projecting at the upper ends, occasionally doubly serrate leaf margins, costae serrate above, and costal tips strongly projecting as spines is suggestive of a close generic relationship to *Hookeriopsis* sensu lato.

Cerro Amboró, within Amboró National Park, is an area with deep sandstone canyons lying between the high tropical Andes of the Cordillera Real, the sub-Andean ranges of Chuquisaca and Tarija, and the sandstone ranges of the Chiquitos. *Clusia* shrublands, grading into isolated grasslands, dominate the upper slopes of Cerro Amboró. The lower canyons are densely forested, and isolated riverine forests follow the deeper canyons nearly to the summit. During a botanical expedition to the summit of Cerro Amboró (September 1990), the senior author collected extensively in the upper canyon forests where an unusual species was encountered along rills and creeks from 900 to 1,250 m. The species has features found in *Hypnella*, *Hookeriopsis* sensu lato, and *Callicostella*, but the presence of pluripapillose cells indicates the first-named genus. This taxon is unlike any known species of *Hypnella*.

Hypnella ambrosia M. Lewis & B. Allen, sp. nov. TYPE: Bolivia. Santa Cruz: Prov. Ichilo, Cerro Amboró, between upper Río Isama and summit, ca. 35 km S of Buena Vista, Parque Nacional de Amboró, Cerro Amboró, 17°45′S, 63°39′W, ca. 900 m, *Lewis 37820* (holotype, LPB; isotypes, MO, NY). Figures 1–7.

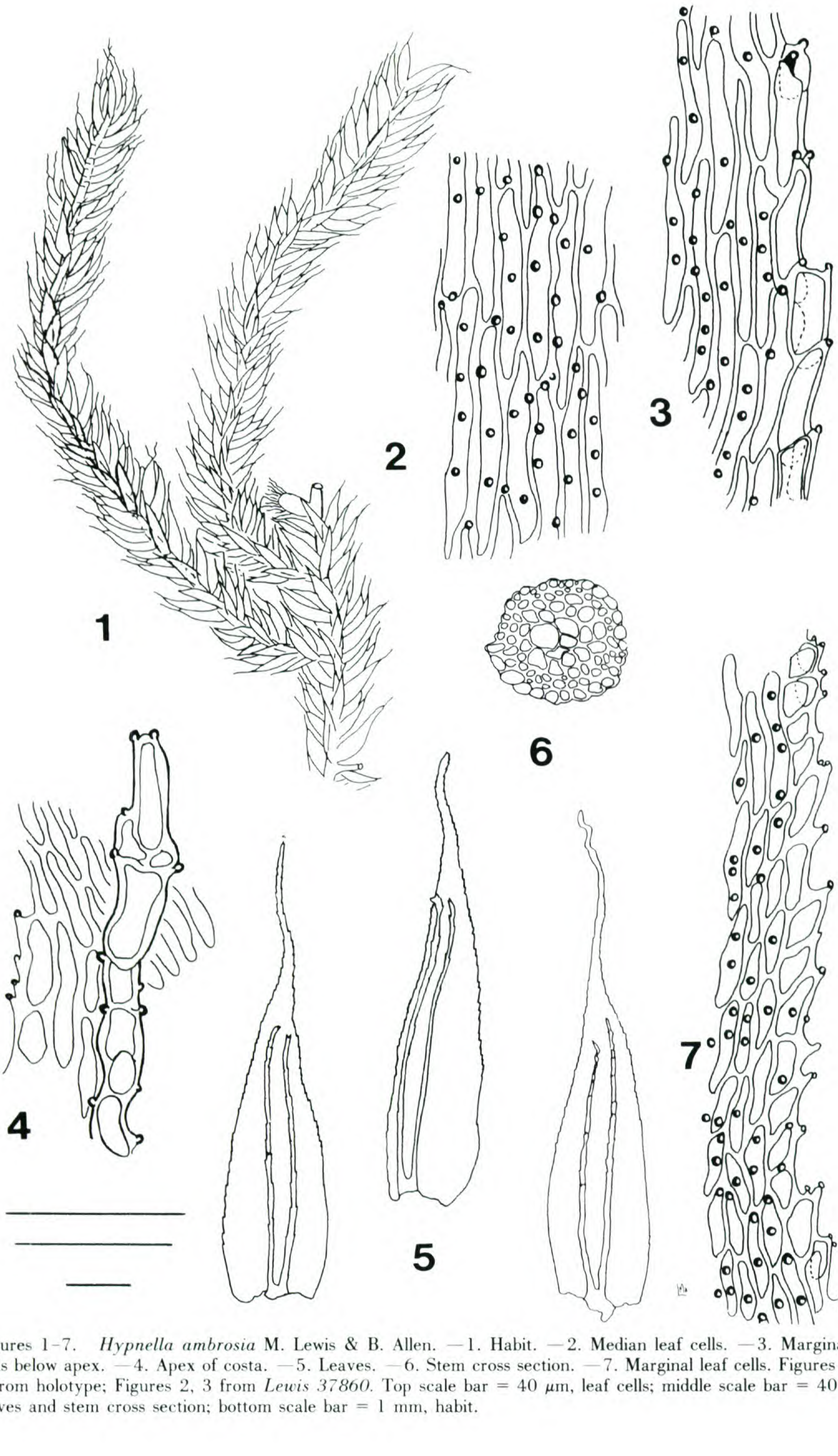
Species nova *Hypnellae piliferae* proxima foliis gradatim angustatis, acuminatis, longis differt.

Plants in thin green mats, occasionally purple tinted. Stems red, 2–3 cm long, 0.1–0.15 cm wide, central strand absent, epidermal cells somewhat differentiated, thin-walled, enlarged, at times appearing as a hyaloderm, not fluted; axillary hairs 2-celled, the basal cell quadrate, red-brown, the upper cell swollen, oblong, hyaline; pseudoparaphyllia absent; paraphyllia absent; irregularly branched, branches ± parallel. Leaves complanate wet or dry, erect when dry, spreading to wide-spreading when wet, lanceolate to oblong-lanceolate, gradually narrowed to long, slender, flexuose acumina, 1.0–1.8 mm × 0.15–0.30 mm, margins weakly serrate at middle, strongly serrate at apex, teeth mostly single, occasionally double, each tooth often ending in a papilla; costae double, ± parallel, projecting as 1–2-celled spines near the base of the acumen, with multicelled serrations along the upper margins, serrations often ending in 1 or 2 papillae, in cross section rounded, with 3–4 layers of homogeneous, uniformly thick-walled cells; leaf cells thin-walled throughout, at insertion reddish or hyaline, rectangular, 30–40 μm × 6–8 μm, basal cells long rectangular, 25–47 μm × 5–6 μm, upper cells elongate fusiform to vermicular, 23–53 μm × 6–8 μm, upper marginal cells somewhat wider and shorter than laminal cells, cells with single papillae variously placed over the surface and often projecting at the upper cell ends, or 2–4 papillae scattered, at times in irregular horizontal rows, over the surface of the cell lumina. Sporophytes unknown.

Paratypes. BOLIVIA. SANTA CRUZ: Prov. Ichilo, Cerro Amboró, ca. 35 km S of Buena Vista in Parque Nacional de Amboró, 17°45′S, 63°39′W, *Lewis 37823*, *37859*, *37860* (all LPB, MO).

Hypnella ambrosia is common on the banks of creeks and rills in the upper canyons of Cerro Amboró between 900 and 1,250 m. It appears to be semi-aquatic and is especially abundant in areas near creek high-water levels and seepy zones near springs and rills. It grows on soil and bare rock. Its soft, pale green, occasionally red-tinted, flattened mats make it a distinctive element of the upper canyon forests of Amboró.

Hypnella ambrosia is similar to *Callicostella* in having some cells with single papillae; however, its



Figures 1–7. *Hypnella ambrosia* M. Lewis & B. Allen. —1. Habit. —2. Median leaf cells. —3. Marginal leaf cells below apex. —4. Apex of costa. —5. Leaves. —6. Stem cross section. —7. Marginal leaf cells. Figures 1, 4–7 from holotype; Figures 2, 3 from *Lewis 37860.* Top scale bar = 40 μm, leaf cells; middle scale bar = 400 μm, leaves and stem cross section; bottom scale bar = 1 mm, habit.

long, vermicular, frequently pluripapillose leaf cells remove it from that genus. Long leaf cells (occasionally with projecting end-walls), short, broad, double-toothed marginal cells, and strongly serrate costae that may end in distinct spines are all features of *Hookeriopsis* sensu lato. The long, pluripapillose leaf cells of this species place it in *Hypnella*. *Hypnella* and *Hookeriopsis* sensu lato are closely related, as demonstrated by several shared features. For example, leaves of *Hypnella pilifera* (Hook. & Wils.) A. Jaeger occasionally have weakly spined costae, and the marginal cells of *Hypnella leptorrhyncha* (Hook. & Grev.) A. Jaeger frequently have projecting ends. *Hypnella ambrosia* is close to *H. pilifera* (Hook & Wils.) A. Jaeger. The latter species has oblong leaves, often wider above the middle, that are abruptly narrowed to the acumen. Although the lower marginal leaf cells in *H. pilifera* are long and narrow, the marginal cells in the upper one-third can be short and broad. There are now seven species in *Hypnella* (Crosby et al., 1985; Allen, 1986; Buck, 1990). They are separated in the following key.

KEY TO THE SPECIES OF *HYPNELLA*

1. Leaves long acuminate, subpiliferous or piliferous 2
1. Leaves long-acute, subacute or obtuse 4
2(1). Leaves rounded at the apex, abruptly piliferous ..... *H. pilifer* (Hook. & Wils.) A. Jaeger
2. Leaves gradually and evenly long acuminate to a piliferous apex 3
3(2). Marginal leaf cells long, narrowly fusiform; costae smooth above, not or very weakly projecting by a single cell .... *H. leptorrhyncha* (Hook. & Grev.) A. Jaeger
3. Marginal leaf cells short, broadly rectangular; costae serrate above, strongly projecting by two or more cells .... *H. ambrosia* M. Lewis & B. Allen
4(1). Leaves ecostate; leaf cells all papillose or entirely to partly smooth ....*H. guayanensis* B. Allen & Buck in Buck
4. Leaves costate; nearly all leaf cells papillose 5
5(4). Leaves long-acute, apex serrate by projecting cell wall ends, ± bordered by long narrow ± smooth cells ..... *H. punctata* Broth.
5. Leaves subacute or obtuse, apex serrulate due to lateral, projecting papillae, not bordered ... 6
6(5). Leaf papillae mostly multifid; leaves obtuse, not apiculate, 0.5–1.0 × 0.2–0.4 mm; monoicous; exostome furrowed; capsule neck tubercular to scabrous .... *H. pallescens* (Hook.) A. Jaeger
6. Leaf papillae simple; leaves subacute, apiculate, 1.0–1.2 × 0.3–0.6 mm; dioicous; exostome not furrowed; capsule neck papillose ..... *H. diversifolia* (Mitt.) A. Jaeger

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New Species of *Passiflora* Subgenus *Plectostemma* (Passifloraceae)

John M. MacDougal
Missouri Botanical Garden, P.O. Box 299, St. Louis, Missouri 63166-0299, U.S.A.

ABSTRACT. Four new species are described, one with two distinct subspecies: *Passiflora* (sect. *Cieca*) *juliana*, *P.* (sect. *Cieca*) *xiikzodz* subsp. *xiikzodz* and subsp. *itzensis*, *P.* (sect. *Pseudodysosmia*) *oaxacensis*, and *P.* (sect. *Xerogona*) *escobariana*. *Passiflora juliana* appears to be the closest relative of *P. viridflora* Cavanilles, a species that traditionally has been segregated as a distinct section or subgenus.

Revision of Mexican, Central American, and Colombian collections of passionflowers is yielding numerous undescribed species, especially among the small-flowered subgenus *Plectostemma* Masters. Apetalous passionflowers, found only in subgenus *Plectostemma*, form a group of about 18 closely related species called section *Cieca* (Medikus) DeCandolle. This section is most diverse and common in northern Mesoamerica and southern Mexico, with a radiation of relatives of *P. suberosa* Linnaeus in the Caribbean. There are at least two other apetalous species in other sections, but these occur independently elsewhere in the subgenus. The following two new species are in section *Cieca*.

Passiflora juliana J. MacDougal, sp. nov. TYPE: Mexico. Michoacán: Mun. Coahuayana, high point on coastal road (Hwy. 200) between San Telmo and San Juan de Lima, 70 m, 2 Nov. 1979, *J. M. MacDougal 492* (holotype, DUKE; isotypes, CAS, CHAPA, DUKE, ENCB, F, GH, IBUG, MICH, MO, MEXU, NY, TEX, US, XAL). Figure 1.

Passiflora ad sectionem *Ciecam* pertinens, scandens; stipulae (3–)5–12(–15) mm latae; petioli in parte media biglandulosi; folia peltata glandulosa trilobata, lobis acutis vel plerumque obtusis vel subrotundatis, marginibus integris; pedunculi ebracteati; stipes floralis 2–4 mm longus; petala nulla; coronae filamenta 2-seriata, filamentis exterioribus 6–8 mm longis, viridiflavis; operculum plicatum; androgynophorum 4–5 mm longum; ovarium glabrum; fructus baccatus atropurpureus; semina 3.7–4.1 mm longa, reticulatim foveata.

Vine (1.5–)2–3 m, minutely to microscopically puberulent throughout at the shoot tip with antrorsely appressed curved trichomes 0.08–0.12 mm long, except adaxial surface of laminas and stipules glabrous; plant glabrescent below. Stems ca. terete to elliptical, often reddish, with minute appressed trichomes. Stipules (6–)10–20(–23) × (3–)5–12(–15) mm, foliose, asymmetrically obovate (to ovate), acute; petioles 1–4 cm, 2-glandular (0.25–)0.3–0.6 the distance to the apex, the nectaries 2 × 1.0–1.5 mm, saucerlike, fleshy, subsessile or narrowed at the base; laminas 3.5–10 × 6–16 cm, peltate (3–)5–15 mm from margin, entire, sometimes variegated as juveniles, the variegations scattered as small patches of white, this rarely retained at reproduction, depressed obovate to widely depressed obovate in general outline, 3-lobed 0.40–0.72 the distance to the peltate base, 5–7-veined, glabrous and often matte adaxially, glabrescent and glaucous abaxially, the lobes elliptic or more usually obovate (or the central widely obovate), apices obtuse or sometimes rounded, the central lobe narrowed at base, the angle between the lateral lobes (80°–)110°–160°; juvenile leaves more deeply lobed with narrow segments; laminar nectaries present as 2–6(–10) sessile submarginal glands distal to lateral veins, (one juvenile plant seen with 1 gland per lateral lobe also proximal to lateral veins), glands 1 mm or less in diameter, (2–)3–5 mm from margins. Peduncles (1)2 per node, 7–20(–27) mm long, uniflorous, green (one individual seen with branched peduncles, 1–2(–3)-flowered); bracts absent; conspicuous inflorescences 5–19 cm long often present as condensed terminal shoots with aborted laminas, the petioles and their nectaries still present. Flowers borne facing above the horizontal to nearly vertical, yellowish green, with a hardly detectable slightly sweet odor, open and receptive from late morning past midday; stipe 2.0–4.0 mm; hypanthium ca. 7–8 mm diam.; sepals (9–)10–12 × 4.0–6.0 mm, light green or yellowish green, with no apical projection; petals absent; coronal filaments in 2 series, the outer ca. 28–48, 6–8 mm long, tapering to points at tips, slightly laterally compressed, opening to or slightly more than 180°, light greenish yellow to light yellow apically, unmarked or with a mere flush of purplish or reddish spots adaxially at base, the inner 3.2–3.7 mm, erect to slightly spreading, greenish yellow and sometimes with a tinge of purplish at very base, capitellate; operculum 2 mm long, membranous, plicate, greenish yellow; limen floor violet to dark

Figures 1–3. —1. *Passiflora juliana* J. MacDougal, with beginning of terminal inflorescence (*MacDougal 492GR*). Scale bar = 1 cm. —2. *Passiflora xiikzodz* subsp. *xiikzodz* (*MacDougal 4677*). Scale bar = 1 cm. —3. *Passiflora xiikzodz* subsp. *itzensis* (*MacDougal 4633*). Scale bar = 1 cm.

purple, its raised edge white or purplish and slightly inclined toward androgynophore; androgynophore (4.0–)4.5–5.0 mm long, whitish or pale green with the purple coloring of the limen ascending only a few mm at base, or purple nearly to the apex; staminal filaments free 3.0–3.5 mm, light greenish, anthers 3.3–4.0 mm long, light greenish, not spotted or marked; pollen light yellow; ovary 2.4–3.0 × 1.5–2.0 mm, ellipsoid, glabrous, green; styles 4.0–5.0 mm total length, including stigmas, the stigmas 1.5 mm diam., light green. Fruit 1.3–2.5 × 1.3–2.0 cm, depressed globose to slightly ellipsoid, sometimes somewhat trigonal-round in cross section, estipitate, bluish black with a white bloom, thus appearing dark gray-blue, exocarp mildly fruity, neither sweet nor sour; arils clear, with a distinct white line (funiculus) on the side, close fitting, ± tasteless; seeds 3.7–4.1 × (2.2–)2.5–2.9 mm, slightly campylotropous, the chalazal beak slightly inclined toward the raphe, reticulate-foveate with 11–15(–18) foveae per side. Germination epigeal. Chromosome number $2n = 12$.

Distribution and habitat. Passiflora juliana is restricted to the coast and coastal plain of southwestern Mexico. It is not uncommon near rocky cliffs overlooking the Pacific Ocean and in the coastal forest in the hills and away from the coast. Collectors' notes give the following habitats: common on road-cut banks and cliffs in sun; on rocky ledge of arid slope with low scattered trees; in shrubs; wooded plain of *Crescentia–Juliania* savanna; selva baja caducifolia; bosque tropical caducifolia; abundant on shrubs on low mountain summits with deciduous woodlands; thickets and rocks at cliff-tops; roadside thickets; grows best in sunny areas; dappled shade of secondary forest of low stature. In Michoacán I found it associated with or near *Passiflora holosericea* Linnaeus, *P. goniosperma* Killip, *P. mexicana* A. L. Jussieu, and *P. filipes* Bentham.

Paratypes. MEXICO. COLIMA: Mun. Tecoman, N of Tecoman, 3.9 mi. NE on Hwy. 110 from jct. of road to Tecoman (Hwy. 200), 30 Oct. 1979 (fl), *MacDougal & Miley 486* (CAS, CHAPA, DUKE, ENCB, IBUG, MEXU, MICH); 15 mi. SE of Tecoman, near Cerro de Ortega, 0–50 m, 9 Dec. 1959 (fl), *McVaugh & Koelz 1615* (MICH); 7 mi. N of Santiago, rd. to Durazno, Jalisco, via bridge over Río Cihuatlán, 200 m, 30 July 1957 (fl), *McVaugh 15924* (MICH). JALISCO: 2 km by road E of Cihuatlán, 0–50 m, 8 Mar. 1970 (fl), *Anderson & Anderson 6154* (MICH); 19°30′N, 105°03′W, 6 Jan. 1983 (fl), *Lott 1701* (DUKE, MEXU); Mun. La Huerta, entrada a la verada a las Piletas cerca de Rincón de Ixtlán, viejo camino a Nacastillo, 12 Aug. 1983 (fr), *Lott 1832* (DUKE, MEXU); Mun. Cihuatlán, 2.8 mi. W on Hwy. 200, 4.2 mi. E of road to Barra Navidad, 10 Nov. 1979 (fl), *MacDougal & Miley 507* (MO-spirit); Mun. La Huerta, Estación de Biología Chamela, 10 Dec. 1976 (fr), *Magallanes 344* (DUKE, MEXU); 13 Dec. 1976 (fl, fr), *Magallanes 364* (MEXU); high rocks above the Pacific Ocean, Rancho Paraíso, 10 km SE of Chamela, 20 m, 14 Feb. 1975 (fr), *McVaugh 26277* (MICH). MICHOACAN: Mun. Apatzingan, Tancitaro region, Mt. Apatzingan, 2,000

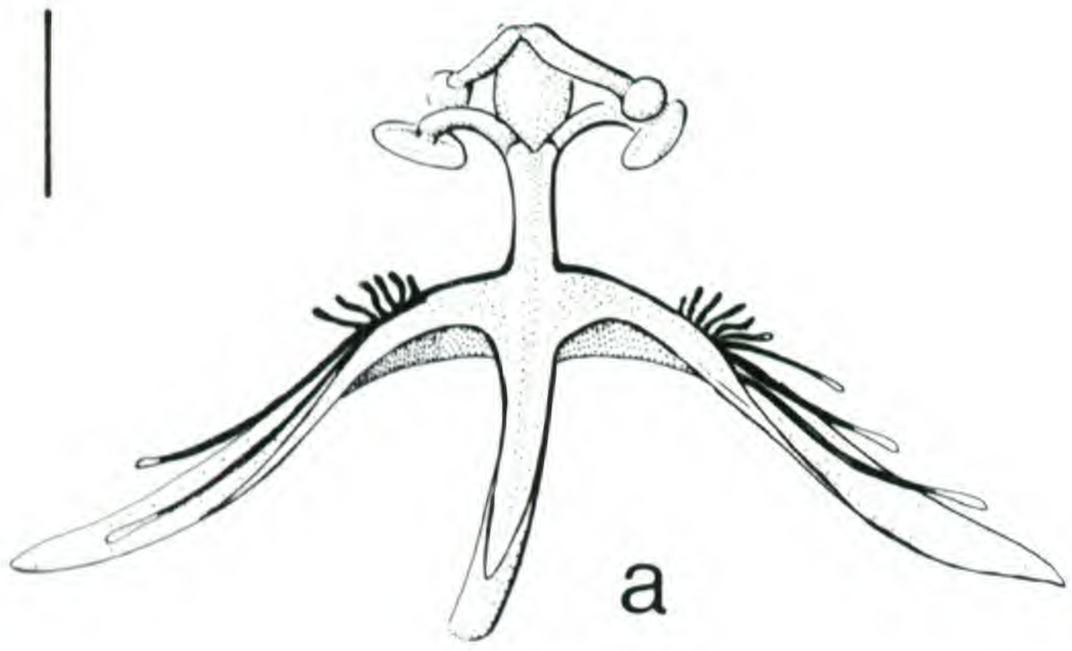

Figure 4. Diagram of floral cross sections of *Passiflora xiikzodz* J. MacDougal. Scale bar = 5 mm. —a. *P. xiikzodz* subsp. *xiikzodz* (*MacDougal 4677*). —b. *P. xiikzodz* subsp. *itzensis* (*MacDougal 4633*).

ft., 20 Aug. 1941, *Leavenworth & Hoogstraal 1717* (F); Mun. Coahuayana, 7.7 mi. SE from Río Coahuyana on Hwy. 200, 31 Oct. 1979, *MacDougal & Miley 489* (DUKE); Mun. Huetamo, 3 km al NW de Eréndira, sobre el camino a Carácuaro, 800 m, 6 Nov. 1977, *Rzedowski 35506* (ENCB).

Passiflora juliana very closely resembles *P. viridiflora* Cavanilles vegetatively, except that it has notably wide and foliose stipules and the stem is not as bright red. The length of the androgynophore is the main difference between the two: *P. viridiflora* has an elongate tubular flower, while *P. juliana* has the shallow-dish shape that is usual in the section and subgenus. Both inhabit similar habitats along the Pacific Coast of Mexico, with *P. juliana* to the north and *P. viridiflora* southward down the coast, from Acapulco to the Isthmus of Tehuantepec. The two species apparently are not sympatric, but the possible zone of contact has not been sampled. They are undoubtedly sister species.

Passiflora viridiflora is pollinated by hummingbirds in coastal Oaxaca (A. Lau, pers. comm.). The usual pollinator of *P. juliana* is unknown; my one morning of observation yielded only a single hurried visitor—a hummingbird. The floral structure of *P. juliana* suggests adaptation to a small or medium-sized insect.

The discovery of a passionflower that is clearly referable to section *Cieca*, but that very closely resembles *P. viridiflora* (except for the bird-adapted flower), reinforces the placement of *P. viridiflora* in section *Cieca*, a position previously suggested by MacDougal (1983).

Passiflora viridiflora has been recognized as a distinct monotypic genus, *Synactila* Rafinesque, and at various infrageneric ranks within *Passiflora*, but the discovery of this new species with intermediate morphology confirms that *P. viridiflora* is not as distinct as once thought. The elongate flower probably merely represents a shift in pollinators.

Passiflora juliana has a conspicuous terminal infloresence on older plants that consists of a condensed shoot with extremely reduced or aborted laminas. A short petiole remains at each node and the petiolar nectaries are well developed and active. The shoot of the inflorescence is not determinate, however, and vegetative growth with normal leaves and longer internodes often continues after weeks or months of blooming. This inflorescence is identical to those seen in the related species, e.g., *P. viridiflora* and *P. coriacea* A. L. Jussieu. Laminar nectaries are distal to the lateral veins except in one specimen, *Rzedowski 35506*, where single glands occur proximal to the main veins of each lateral lobe. Plants from Jalisco and Colima tend to have more laminar nectaries than the forms from Michoacán, with up to 8 or 10 per leaf. The type gathering consisted of several individuals growing adjacently. Branched peduncles, seen only in one individual of the type gathering (cf. isotype, DUKE), are to be considered an abnormal condition in this species. This character state is not shared with any other collection of *P. juliana*, nor with other species in section *Cieca*, except that it has been observed in certain races of *P. suberosa* (cf. *MacDougal 421*).

A few seeds from fruits on the type gathering were stored dry and clean for 2½ months, then sown. Germination was excellent within 10 days, and the seedlings were numbered *MacDougal 492GR*. In 1983 several of these seedlings were distributed to the horticultural trade in California and made available at the retail level in limited quantities. Less than 20 cuttings were distributed in the next decade, but clones are still available from several growers. The chromosome count was from *MacDougal 492GR* (Snow & MacDougal, in press).

Passiflora juliana appears to be self-incompatible, as no fruits were produced from over 50 controlled self-pollinations performed on *MacDougal 492GR* in the greenhouse. No fruits have been produced by autogamy during ten years of cultivation. Hybrids were produced from *492GR* on an extremely limited basis by MacDougal in 1982 by

crossing *P. juliana* with *P. trinifolia* Masters and *P. tenuiloba* Engelmann. The several plants grown of these two crosses were variegated (chimera-type) and dwarfed like their smaller parents, but otherwise were essentially intermediate to the parental morphology. Hybrids flowered with normal-looking, intermediate flowers with abundant pollen; pollen viability or stainability has not been examined. Fertile vouchers of examples of these crosses are deposited at DUKE.

Dried leaf samples of *MacDougal 492GR* (as *492*) were chromatigraphically screened by McCormick (1982) for flavonoids. Flavonol 3-*O*-glycosides but not *C*-glycosylflavones were detected. This is an unusual pattern in Passifloraceae, and was found in all of the species of section *Cieca* that contained any flavonoids, including *P. viridiflora* (McCormick, 1982).

Lacebugs and the butterfly *Heliconius charitonius* were important herbivores on *MacDougal & Miley 486*.

The species is named for Julianna Miley, my former wife and beloved companion during the Mexican and Guatemalan fieldwork of 1978 to 1980. Her enthusiastic assistance resulted in the discovery or re-collection of many species of passionflowers.

Passiflora xiikzodz J. MacDougal, sp. nov. TYPE: Mexico. Campeche: Tuxpeña, [18°26′N, 90°06′W], 19 Jan. 1932, *Lundell 1210* (holotype, MICH; isotypes, ARIZ, DS, F, GH, MICH, MO, NY, US, WIS—2 sheets, U). Figures 2–4.

Passiflora ad sectionem *Ciecam* pertinens, ad rupes calcareas scandens; stipulae 0.4–0.7 mm latae; petioli ad apicem biglandulosi; folia peltata glandulosa bilobata vel truncata vel raro trilobata, lobis lateralibus acutis vel raro acuminatis, marginibus integris; pedunculi ebracteati, stipes floralis 12–30 mm longus; petala nulla; coronae filamenta 5–7(–8)-seriata, filamentis exterioribus filiformibus 8–12 mm longis, pro parte maxima atropurpuris, ad apicem flavidis; operculum ad basim in denticulos laceratum; androgynophorum nullus vel 0.5–4 mm longum; ovarium glabrum; semina ca. 4.3–5.5 mm longa, reticulatim foveata.

Vine ca. 1–3(–6) m, minutely to microscopically puberulent throughout with antrorsely appressed, curved blunt trichomes 0.08–0.12 mm long, and sometimes also straight, erect, capillary trichomes to 0.3 mm long, except the laminas glabrous or nearly so; plant glabrescent below. Stems subterete to obtusely subangular, ca. scabrous, minutely puberulent. Stipules (2.8–)3.5–6.5 × 0.4–0.7 mm, linear to linear-lanceolate; petioles 1–2(–3) cm, 2-glandular at or near the apex (or at least on the distal ¼), 0–5(–10) mm from the apex, the nectaries 0.7–1 × 1.3–2 mm, saucerlike, fleshy; laminas (1.2–)1.5–7.5 × (3.5–)5–19 cm, peltate (2.5–)3–5(–10) mm from margin, entire, usually strongly variegated along main veins as juveniles, often variegated at reproductive nodes, depressed obovate to shallowly obtriangular to narrowly transversely elliptic, 2(–3)-lobed or ca. truncate, 5(–7)-veined at base, the lateral lobes (acuminate to) acute, often rounded at the very apex, the central lobe retuse to obsolete (or obtuse), the angle between the lateral lobes (75°–)90°–130°(–150°); laminar nectaries (6–)8–16(–28) per leaf, borne 1–12 mm from margin, both proximal (exmedial) to the primary lateral veins and between the primary lateral and central veins. Inflorescence often present to 20 cm long as a condensed terminal shoot with aborted laminas, the petioles and their nectaries still present. Peduncles (1)2 per node, 1–7(–10) mm, uniflorous; bracts absent. Flowers borne vertically, with no detectable odor, light yellowish green, the corona dark violet or purple, apically yellowish; stipe 12–30 mm; hypanthium ca. 6–9 mm diam.; sepals (8–)10–14.5 × 3.5–6.0 mm, narrowly triangular to oblong triangular, outermost two slightly cucullate, with no apical or subapical corni, greenish yellow inside and out, or greenish outside and lightly flushed with reddish purple, reflexed at anthesis so that calyx is open ca. 240°; petals absent; coronal filaments in ca. 5–7(–8) series, the outermost series 8–12 mm long, subequal to sepals, very slender-filiform, reflexed slightly more than the sepals at anthesis, the inner ca. 3–7 series 0.5–3 mm, the three innermost series greatly apically dilated-capitate; operculum represented by vestigial fan-shaped denticles ca. 0.3 mm long; limen 5–6 mm diam., the floor convex, conspicuously glossy brown, dark purple, or reddish purple, with no raised edge; nectary apparently absent; androgynophore absent or present, when present light greenish yellow and unmarked, or purplish at the base or lower ⅓; staminal filaments not connate, or connate 0.5–4.5 mm along androgynophore, the free portions 2.5–3.5 mm long, greenish yellow and not marked, or dark reddish purple; anthers 1.8–3.0 mm long, greenish yellow, not marked, dehiscence extrorse or distal; pollen yellow; ovary 1.9–2.5 × 1.3–2.0 mm, ellipsoid, glabrous; styles 1.5–5.5 mm long including stigmas, light greenish yellow or green, unmarked; stigmas capitate, 1.2–1.9 mm diam. Fruit ovoid. Arils and germination unknown. Chromosome number $2n = 12$.

Distribution and habitat. Edges, thickets, secondary and primary growth on limestone outcrops or on walls of cenotes, most usually collected on

Mayan ruins or small cliffs, in tropical humid or subdeciduous forest, Yucatan peninsula and adjacent Guatemala and Belize, 100–300 m. It has been found growing with the similar *P. coriacea* at some sites.

Ethnobotany. Vernacular names are "Bat wing" (Belize), "Yerba del cuate" (Campeche), "Zodz' ak'" (Yucatán), and most commonly "Xiik zodz" (variously transcribed as "Xig-Sodz," "Xi'ik so'otz," "Xiik zotz," or "Shig sots") (Yucatán, Campeche). In Belize, "used in a mix to treat pain" (*Hodges & Klassi 20*).

Passiflora xiikzodz presents a fundamentally different floral corona from other species in section *Cieca;* furthermore, there is no floral nectary. The corona is highly proliferated, 5–7-seriate instead of 2-seriate, not counting the operculum. Even the operculum is different. While almost all species in the genus have a nectary-cover called an operculum formed by the innermost corona (fused-membranous or not), this protection against rain, useless visitors, and desiccation is lacking in *P. xiikzodz*, the remnants existing only as minute teeth. A floral nectary is absent, and no nectar is formed. The reward for the pollinators is unknown. Pollen might be the reward, but the shiny convex limen is deceptively similar to glistening nectar, and the possibility of attraction by deception should be investigated.

The floral stipe (that portion of the pedicel distal to the articulation) is diagnostically long, 12–30 mm, longer than most other species in the genus. The seeds are unusually elongate for species in section *Cieca* or subgenus *Plectostemma*, being more than two times longer than wide.

The leaves of *P. xiikzodz* are very similar to those of the closely related *P. coriacea;* both are transversely oblong, peltate, with laminar nectaries proximal to the lateral veins, and variegated or not. They are easily distinguished by the position of the large, paired petiolar nectaries. In *P. coriacea* the glands are near the middle of the petiole. In contrast, *P. xiikzodz* has the glands distal or apical on the petiole. The glands are often not visible from above the leaf, being hidden under the base of the blade.

This batwing plant has in its northern populations a variant with a truly unusual flower. The populations around Chichen Itza, Yucatan, have been sampled and grown in the greenhouses; careful study of fresh flowers revealed that the central reproductive structures are shortened and modified so that the flower must dust the pollen on the ventral surface of the pollinators, not on the dorsum as does the southern form. Other differences combine to suggest a cohesive unit recognized here as a separate subspecies.

KEY TO THE SUBSPECIES OF *PASSIFLORA XIIKZODZ*

1a. Androgynophore 2.6–4.5 mm long; free portions of staminal filaments spreading perpendicular to androgynophore at floral anthesis, the anthers dehiscing proximally, toward corona; styles (including stigmas) 3.5–5.5 mm long ..... *P. xiikzodz* subsp. *xiikzodz*

1b. Androgynophore absent or to 1.0 mm long, the ovary sessile or nearly so; free staminal filaments suberect at anthesis, the anthers dehiscing distally, away from the corona; styles (including stigmas) 1.5–2.0 mm long ..... *P. xiikzodz* subsp. *itzensis*

Passiflora xiikzodz J. MacDougal subsp. **xiikzodz**

Hypanthium 7–9 mm diam.; staminal filaments connate along androgynophore 2.6–4.5 mm, the androgynophore pale greenish yellow or sometimes purplish brown at base, the free staminal filaments greenish yellow, not marked with purple, reflexing to become perpendicular to the androgynophore at anthesis; anthers extrorse; styles (including stigmas) 3.5–5.5 mm long. Fruit 2.0–3.2 × 1.5–2.2 cm, ovoid, slightly 3-sided, purplish black, estipitate; seeds (4.3–)4.5–5.5 × 1.9–2.3, obcampylotropous, the chalazal beak inclined toward raphe, reticulate-foveate with 13–20(–22) foveae per side. Chromosome number $2n = 12$. Figure 2, 4a.

Paratypes. BELIZE. COROZAL: Cerros Maya ruins, Lowry's Bight, coastal area, 8 Apr. 1983, *Crane 513* (LL); without locality, 1931–1932, *Gentle 255* (MICH, US). EL CAYO: El Cayo, river bluffs, 15 Feb. 1931 (juvenile and seedling), *Bartlett 11496a* (MICH); El Cayo, 5–13 Mar. 1931, *Bartlett 12012* (MICH); hillside near Camp 6, 17 Mar. 1938 (fl), *Gentle 2377* (MICH); Macal River, 20–25 Aug. 1991, *Hodges & Klassi 20* (MO); ruins of Xunantunich, coll. by J. Turner, *MacDougal 4677* (MO); ruins of Xunantunich, 17°05′N, 89°08′W, 600–700 ft., 2 Dec. 1968 (fl), *Proctor 29617* (BM); Panti Trail, Ix Chel Farm, Chaa Creek, 21 Mar. 1990 (fr), *J. Turner s.n.* (MO); 1 mi. NE of Benque Viejo on rd. to Xunantunich, 25 Mar. 1990 (fr), *J. Turner s.n.* (MO). TOLEDO: cliff face, Jacinto Hills, 16°09′N, 88°51′W, 400 ft., 4 Nov. 1933 (fr), *Schipp 603* (F). GUATEMALA. PETEN: ruins of Uaxactún, 22 Mar. 1931 (fl), *Bartlett 12270* (MICH); ruins of Uaxactún, 26 Apr. 1931 (fl), *Bartlett 12755* (MICH); ruins of Temple 1, Tikal Nacional Park, 13 Mar. 1966 (fl), *Contreras 5578* (F); Santa Elena, on La Libertad road, km 5, 12 Sep. 1966, *Contreras 6083* (LL); Dos Lagunas, 5 km W on Carmelita road, 6 May 1969, *Contreras 8478* (LL, MO); Lake Petén Itza, cliff along shore E of San José, 22 Jan. 1962, *Lundell 17235* (LL); apotal on hilltop, La Cumbre, San Luis area, bordering Arroyo Quebrada Seca, km 122, 28 Mar. 1977, *Lundell & Contreras 20711* (LL); Plaza Mayor Tikal Ruins, 300 m, 11 Nov. 1967, *Molina 21075* (EAP, F); Tikal, Parque Nacional, km 16 camino Zococzal a Tikal, 12 Sep. 1969 (fl), *Tún Ortíz 271* (EAP, F). MEXICO. CAMPECHE: Campo Experimental Forestal Tropical "El Tormento," km 5 carretera Escárcega a Candelaria, 24 Dec. 1965, *Chav-*

elas et al. ES-153 (MEXU); ruins of Becán, coll. E. Leiter, cult. at MO 1990–1992, *MacDougal 4690* (MO); Mun. Champotón, a 30 km al N de Calakmul a Escársega, 220 m, 4 Feb. 1983 (fl), *Martínez S. & Téllez 2910* (MEXU). QUINTANA ROO: Kohinlich, July 1974, *Boege 3243bis* (MEXU); 16 km al S de San José de la Montana, sobre el camino a Tomas Garrido, 26 Sep. 1983, *Cabrera & Cabrera 5565* (MEXU, MO); cleared ruin, near Xpujil, 18°10′N, 88°45′W, 300–400 m, 18 Aug. 1974 (fl), *Shepherd 210* (WIS).

The specific epithet, *xiikzodz*, is a compound form of the transliteration of the undeclinable Mayan vernacular name for the plant, meaning "bat-wing." The epithet is pronounced (more or less) "sheik zoats." Several other species of plectostemmad passifloras (notably *P. biflora* Lamarck, *P. sexflora* A. L. Jussieu, *P. rovirosae* Killip, and *P. coriacea*) are locally called "ala-murcielago" (Spanish for bat-wing) in northern Mesoamerica, but the shape, texture, and venation of the leaves of this new species particularly suggest a comparison with a bat's wings. The species is endemic to the region of the Old Mayan Empire, and the vernacular name is well known there (E. Leiter, pers. comm.). Most herbarium specimens examined early by me were inscribed with a different manuscript name which may persist on some sheets; corrected labels have been distributed. The chromosome count was from *MacDougal 4677* (Snow & MacDougal, in press).

Passiflora xiikzodz subsp. **itzensis** J. MacDougal, subsp. nov. TYPE: Mexico. Yucatán: Chichen Itza, [20°40′N, 88°34′W], June–July 1938, *Lundell & Lundell 7470* (holotype, LL; isotypes, LL—2 sheets, MEXU, MICH, US). Figure 3, 4b.

Androgynophorum nullus vel 1.0 mm longum; styli breves, fere sessiles, plus minusve immobiles.

Hypanthium 5.8–7 mm diam.; petals almost always absent (but rarely recorded from occasional sports on cultivated plants as (3.5–)5–7 mm × (1–)2.5 mm); androgynophore absent to ca. 1 mm long, the ovary subsessile within the basally fused or free staminal filaments, the filaments dark reddish purple throughout, suberect at anthesis; anthers dehiscing distally; styles (including stigmas) 1.5–2.0 mm long; immature fruit ovoid, otherwise unknown; seeds unknown. Chromosome number $2n = 12$.

Additional specimens examined. MEXICO. YUCATAN: Progreso, 1934, *Flores 2* (F); Lake Chichankanab, [19°54′N, 88°46′W], Apr. 1917, *Gaumer 23714* (F); without further locality, 1917–1921, *Gaumer 24415* in part (F, G, MO); Chichen Itza, near Pisté, [20°40′N, 88°34′W], June–July 1938 (fl), *Lundell & Lundell 7375* (MICH); Chichen Itza, June–July 1938 (fl), *Lundell 7439* (MICH); Chichen Itza, coll. by Dzib Dzib & Leiter, cultivated at MO 1989–1992, *MacDougal 4633* (MO).

The androgynophore in this distinct subspecies is reduced to nearly nothing, the ovary thus subsessile and surrounded by five nearly free stamen filaments thrusting upwards. The presence of a distinct androgynophore is usually considered a generic character in this family, but other species of *Passiflora* have been described with a similarly reduced or absent column (cf. *P. apoda* Harms, *P. multiflora* Linnaeus, *P. ursina* Killip & Cuatrecasas, and *P. monadelpha* Jørgensen & Holm-Nielsen). The anthers in *P. xiikzodz* subsp. *itzensis* differ by not flipping over to an extrorse position after the flower buds open, but instead moving only slightly from the original introrse position to dehisce distally (upwards), away from the corona. The stigmas are nearly sessile on short nonmoving styles, with their receptive surfaces also directed distally. The pollen is thus dusted on the ventral surface of any insect visitor that might walk on the flower. Although pollinators of neither subspecies are known, relatives are hymenopteran-pollinated (sect. *Cieca*, Lindman, 1906; *P. coriacea*, J. Turner, pers. comm.). The difference in placement of pollen between the two subspecies may indicate differences in pollinators, but this remains unknown.

Petals appeared in a few flowers of the cultivated *MacDougal 4633* in October of 1989 and 1991. These were well formed but small, and their occurrence is an anomaly in the otherwise apetalous section *Cieca*.

Both subspecies appear to be self-incompatible. More than 60 artificial self-pollinations of clones of both subspecies proved unsuccessful in the greenhouses, and no fruits have been produced by autogamy in two years of cultivation. Viable seeds were produced easily between two clones of subspecies *xiikzodz* (*MacDougal 4690*, *4677*) and even subspecies *xiikzodz* and *P. coriacea*, with hybrids grown to flowering. The hybrids with *P. coriacea* (*MacDougal 4678*) had normal-looking, intermediate flowers with abundant pollen; pollen viability or stainability has not been examined.

Artificial cross-pollinations in the greenhouse between the two subspecies has proved unsuccessful. About 15 crosses in both directions between *MacDougal 4633* and *4677* have been tried, with aborted fruits with no viable seed formed with *4677* as the pollen donor, and with no fruits formed with *4633* as the pollen donor. The lack of fertility between the two subspecies underscores the divergence of the taxa, but more information would be needed to support the recognition of two separate species.

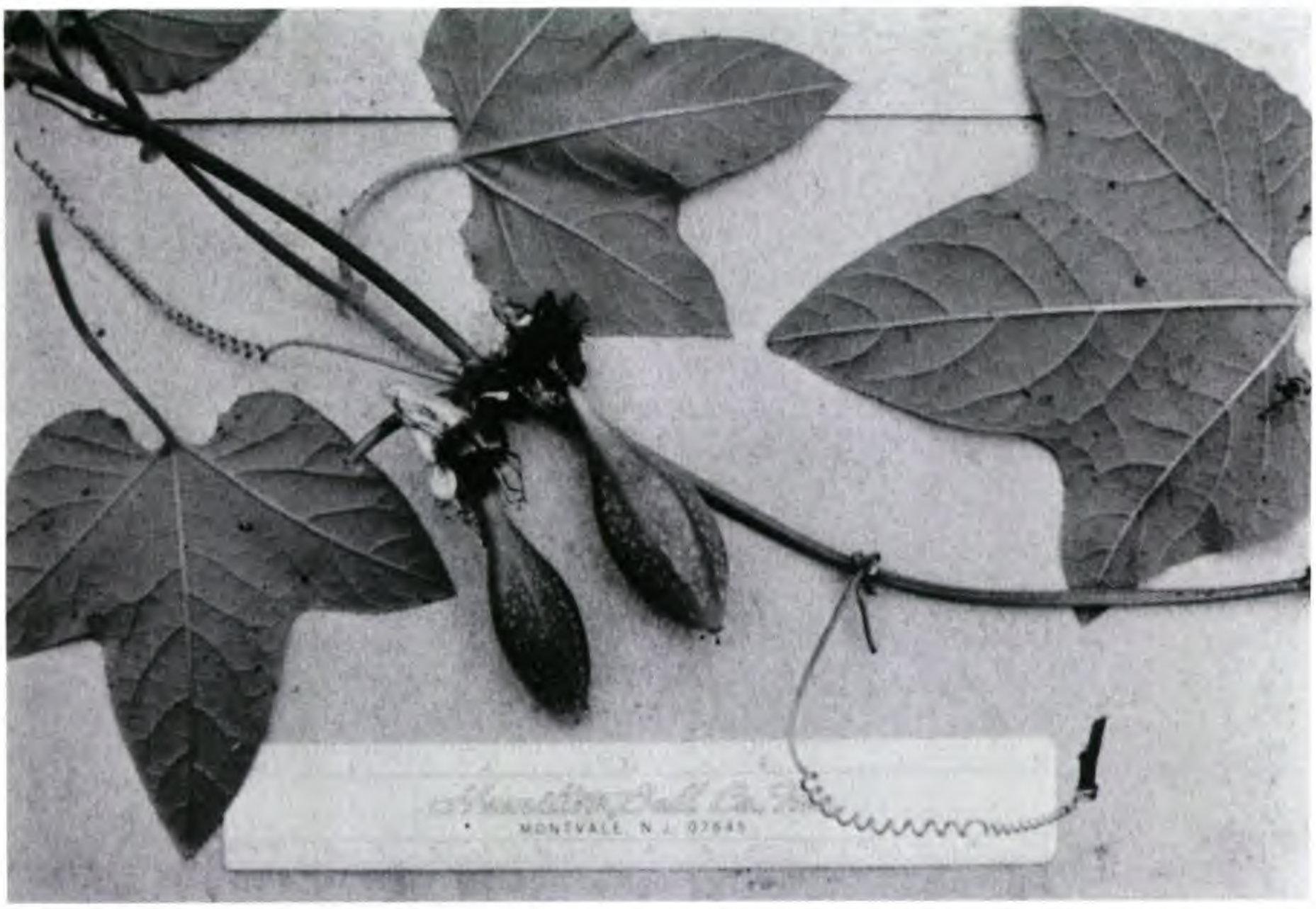

Figure 5. *Passiflora oaxacensis* J. MacDougal, with immature fruit (*MacDougal 329*). White ruler is 16.2 cm long.

The flowers of both variants of *P. xiikzodz* look similar from a distance, although the northern type is smaller, and both have the same unique, convex, shiny limen with modified operculum and proliferation of coronal rows.

The specimens collected by both Flores and Gaumer cited above are tentatively included in this subspecies due to their geographic position at the north of the range, but the specimens are sterile. The chromosome count was from *MacDougal 4633* (Snow & MacDougal, in press).

Passiflora oaxacensis J. MacDougal, sp. nov. TYPE: Mexico. Oaxaca: Distr. Miahuatlán, 1 km N of [San José de] El Pacífico, or 34 km S of Miahuatlán on Hwy. 175 at Km 132, 16°05′N, 96°30′W, ca. 2,500 m, 26 July 1965, *Roe, Roe & Mori 616* (holotype, WIS; photographs, DUKE, MEXU; isotypes, DUKE, ENCB, F). Figure 5.

Passiflora ad sectionem *Pseudodysosmiam* pertinens, scandens, pubescens trichomatis uncinatis; petioli duo glandulis subsessilis infra medium instructi; folia trilobata, basi cordata et denticulata, lobis acute vel acuminate triangularis; bracteae lineares vel setaceae; coronae filamenta uniseriata vel biseriata, filamentis exterioribus 11–14 mm longis; operculum plicatum; ovarium glabrum; arillus rubroaurantiacus; semina reticulatim foveata.

Climbing vine 1.5–3 m with stems apparently annual from slightly thickened perennial roots, sparsely pubescent throughout with 0.25–0.60-mm-long uncinate trichomes; stem subterete and slightly striate to subangulate. Stipules 8–14 × 4–8 mm, ovate-auriculate and apiculate to long caudate, the margins entire and ciliolate; petioles 2.8–6 cm, 2-glandular 0.25–0.50 the distance to the apex, the nectaries 1.0–2.0 mm total length, 1.0–1.8 mm diam., paired or subopposite, pyriform or hemispherical, subsessile to short-stipitate; laminas (5.5–)7–14 × (6.5–)8–15.5 cm, never variegated, 3-lobed 0.30–0.40 (–0.45) the distance to the cordate base, the lobes triangular and acute to nearly acuminate, the central lobe not narrowed at base, the angle between the lateral lobes 85°–110°(–117)°, ratio of lateral to central lobe lengths (0.65–)0.70–0.83, margins proximal to lateral lobes denticulate with 5–8(–10) teeth per lobe, margins distal to lateral lobes entire; laminar nectaries 0.5–0.9 mm diam., 2–3 per sinus, very rarely 1–2 also proximal to lateral lobes, 1.5–6(–9.0) mm from margin, sessile; juvenile leaves more shallowly lobed, 0.10–0.30 the distance to the base, the lobes with convex margins forming a terminal angle of ca. 90°. Peduncles (1)2 per node, 2.0–2.5 cm; bracts (2.6–)3.0–6.5 × 0.15–0.5 mm, linear-triangular to capillary, entire. Flowers 4–5 cm diam., oriented sublaterally but below horizontal, with a pleasant flowery-sweet odor, open and receptive from morning to midday; stipe 0.8–2.5 mm; hypanthium 12–15 (–18) mm diam., conspicuously concave abaxially at junction of stipe; sepals 15–21 × 7–10 mm, ovate-triangular and acuminate, ecorniculate or corni 1–2 mm long, pale yellowish green to greenish white and puberulent abaxially, pale yellowish green

to whitish adaxially; petals 6–7 × 4.5–5.0 mm, (widely) ovate, white; coronal filaments in 1 main series, sometimes with a vestigial second series, the outer filaments ca. 52–56, 11–14 mm long, whitish to cream and sometimes becoming light yellow distally, violet or purplish at base and with 1–3 violet bands 4–9 mm from base, giving the appearance of 2–3 violet rings, or the upper bands sometimes splotchy and run together as one pale indistinct band; inner coronal filaments (if present) 0.25–0.75 mm long, submicroscopic and inconspicuous, capilliform to clavate, generally occurring alternate with the outer filaments, expressed mainly in the sepal sectors, usually absent in the petal sectors, white, purplish at base; operculum 1.6–2.2 mm, whitish or usually whitish with purple streaks near base; limen white or white with purple speckling; staminal filaments connate 6.0–7.0 mm along androgynophore, the free portions 5.5 mm long, very lightly speckled with reddish brown (dried); anthers 3.9–5.0 mm long, the connective speckled with reddish brown at its abaxial proximal end (dried); ovary 4.5–6.3 × 2.1–2.8 mm, ellipsoid, borne on a 0.8–2.0 mm long stipe, glabrous; styles 7–8 mm including stigmas; stigmas 2.0–2.5 mm diam. Fruit 6.0–8.0 cm long including 1.5–2 cm stipe, 2.8–3.0 cm diam., ovoid-ellipsoid, ellipsoid, or slightly obovoid, apically abruptly and bluntly conical, sometimes also with an abrupt nipple, purplish black with white bloom, often light greenish yellow proximally and on stipe; arils ca. 8–9 mm long, medium to very orange, fimbriate at apex, fruity-sour tasting; seeds 4.5–5.0 × 3.0–3.5 mm, obovate to widely obovate, coarsely reticulate-foveate with (15–)16–20 foveae per side; germination epigeal. Chromosome number $2n = 12$.

Distribution and habitat. Known only from several populations near the road over the crest of the Sierra de Miahuatlán of Oaxaca, Mexico, in moist to wet forest at the lower edge of the pine zone, 2,400–2,500 m. *Passiflora oaxacensis* is found on steep slopes in open pine woods, forest edges, disturbed areas, or roadside thickets, climbing herbs, shrubs, and dead branches of tree falls. The forest contains a small amount of oak, and herbs such as *Maianthemum* Wiggers are common. This locality is in an area classified as "húmedo, semifrío," with 1,200–1,500 mm of rain annually and an average annual temperature of ca. 12°C (CETENAL, 1970). This climate type has a restricted distribution in Oaxaca but extends roughly 40 km eastward from San José del Pacífico, with two or three small isolated patches to the west. *Passiflora oaxacensis*, or a close relative, may thus be on other nearby peaks.

Paratypes. MEXICO. OAXACA: W-facing slope, 1.0 mi. N of San José del Pacífico, Distr. Miahuatlán, ca. 7,800 ft., *MacDougal 329* (CHAPA, DUKE); rootstocks of *MacDougal 329* cultivated at Duke University 1979–1980, *MacDougal 329GR* (CHAPA, DUKE, MEXU); Puerto del Pacífico, *Lau s.n. in 1987* (photographs: DUKE); cultivated at the Missouri Botanical Garden 1988–1992 from seeds from *Lau s.n. in 1987*, *MacDougal 3009* (BM, MEXU, MO).

Passiflora oaxacensis belongs in subgenus *Plectostemma* sect. *Pseudodysosmia* (Harms) Killip on account of the plicate operculum, basally serrate leaves, one main filamentous coronal row, large stipitate purple fruit with orange pulp, circinnate development of the tendrils at the shoot apex, and the uncinate trichomes. The species is similar to *P. sicyoides* Schlechtendal & Chamisso, from which it may be distinguished vegetatively by having larger stipules, subsessile petiolar nectaries, angles between the lateral laminar lobes of usually less than 110° compared to usually more than 110°, ratios of lateral to central lobe lengths usually 0.70–0.80 compared to 0.53–0.75, and 10–20 laminar marginal teeth compared to less than 12. Fertile material differs notably by the longer outer coronal filaments 11–14 mm long compared to 4–8(–10) mm long, which number 52–55 compared to 59–65(–70), by having fruits more ovoid than obovoid, and seeds with fewer testal foveae. Additionally, *P. sicyoides* often has peduncles that exceed 30 mm.

A second, vestigial but numerous inner row of coronal filaments is seen in two of the three collections. Other species of this section sometimes have flowers with a few vestigial inner filaments, but here the filaments are numerous although diminuitive and doubtless nonfunctional in the reproduction of the plant.

The chromosome count was made from *MacDougal 3009* (Snow & MacDougal, in press). Clones *MacDougal 329GR* and *MacDougal 3009* were self-incompatible in the greenhouse, based on more than 20 controlled self-pollinations.

This species is named for the State of Oaxaca, Mexico, where it appears to be restricted to a small area.

Passiflora escobariana J. MacDougal, sp. nov. TYPE: Colombia. Antioquia: Mun. de Frontino, road between Nutibarra and La Blanquita, region of Murrí, ca. 24.5 km from Nutibarra, 1,090 m, 8 Feb. 1991, *J. MacDougal, D. Restrepo & D. S. Sylva 3823* (holotype, HUA; isotypes BM, COL, CR, HUA, MEDEL, MO, US). Figure 6.

Passiflora ad sectionem *Xerogonam* pertinens; caulis sub3–5-angularis, vinosus; folia 7–25 cm longa, 6–12

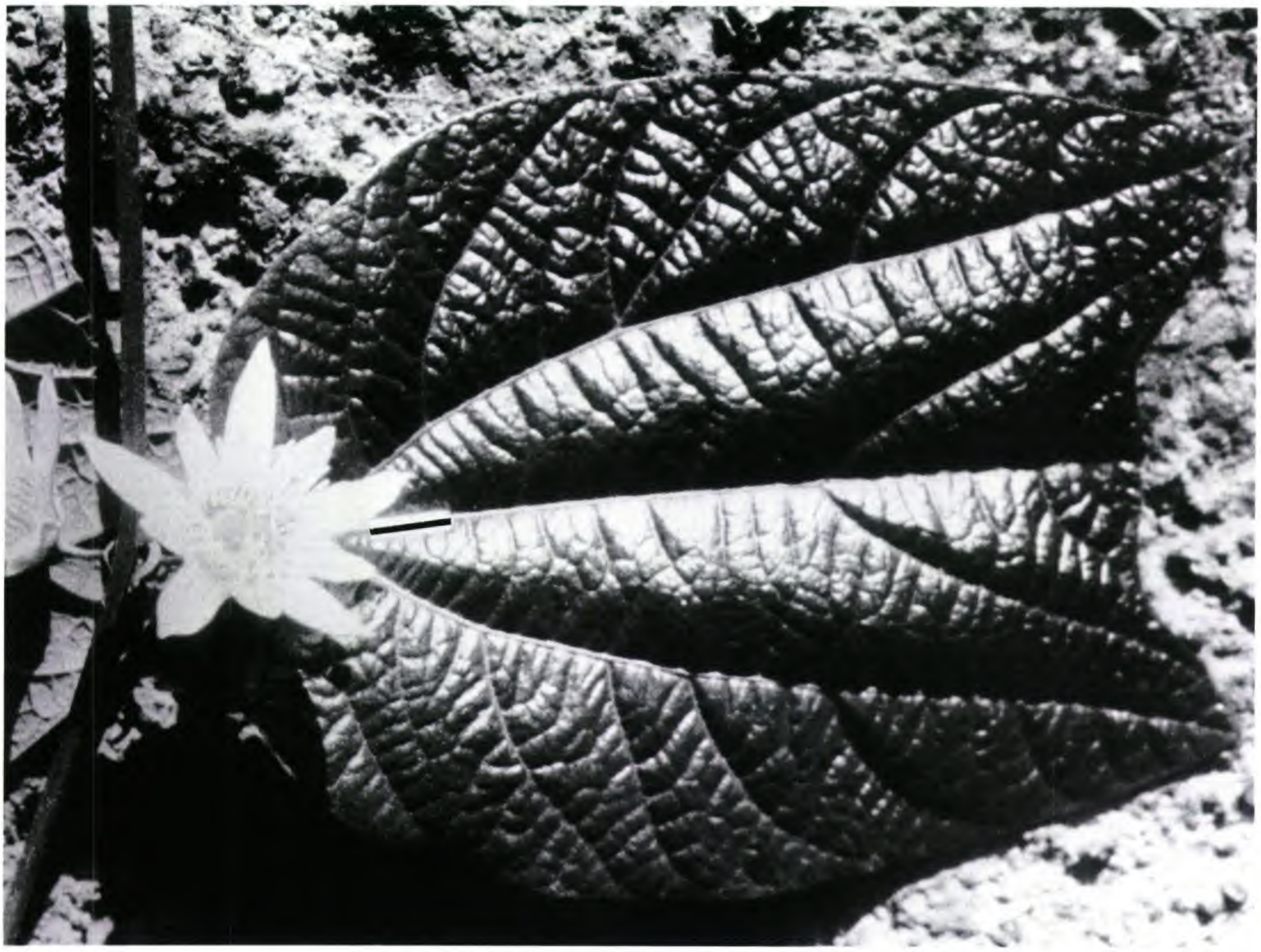

Figure 6. *Passiflora escobariana* J. MacDougal, flowers closing (*MacDougal et al. 3823GR*). Scale bar on midrib of leaf is 1 cm.

lata, eglandulosa nonprofunda bilobata, lobis acutis vel obtusis, marginibus integris, trichomatibus adaxialibus minus quam 0.8 mm longis; pedunculi ebracteati; sepala 15–23 mm longa, 4.5–9 mm lata; coronae filamenta 1–2-seriata, filamentis exterioribus 10–13 mm longis, candidis vel eburneis, parte inferiore roseis; operculum plicatum; androgynophorum 7.0–9.5 mm longum; ovarium minute dense puberulens; capsula fusiformis 6-valvata, carinis rubris.

Vine 5–10 m, minutely puberulent throughout at the shoot tip with 0.04–0.25 mm long antrorsely appressed trichomes. Stems ca. 3–5-angular above, obscurely so below, reddish, puberulent. Stipules 5–7 × 0.5–0.7 mm, linear-triangular or slightly falcate; petioles eglandular, 2.5–6 cm long; laminas 7–25 × 6–12 cm, 2(3)-lobed 0.11–0.20(–0.27) the distance to the shallowly cordate base, with the central lobe always shortest, entire, not variegated, somewhat bullate, adaxially sparsely but evenly pubescent or hirsutellous with straight 0.10–0.5 (–0.8) mm long trichomes, abaxially lightly and evenly pubescent with 0.2–0.3 mm trichomes, the lateral lobes acute to acuminate, the central lobe obtuse, the angle between the lateral lobes 33°–50°; laminar nectaries absent. Older stems cauliflorous, the inflorescence a condensed leafless axillary shoot 1.5–3.5 cm. Peduncles (1)2 per node, (5–)7–26 mm, uniflorous, red; bracts absent. Flowers creamy-white tinged pink, with a reddish center, borne ± upwards, with a mild sweet odor, open from mid-morning to just after midday; stipe (2.5–)4–8 mm (to 12 mm in fruit); hypanthium 10–13 mm diam., very pale greenish or nearly white, sometimes slightly tinged with pink. Sepals (15–)18–23 × (4.5–)6–8(–9.0) mm, narrowly triangular or oblong-triangular, acute, strongly 3-nerved, with no apical projection, whitish, cream, or pale green abaxially, whitish adaxially and sometimes tinged pink or red on the basal part and edges; petals (11–)13–17 × 4.0–5.5 mm, narrowly ovate to broadly lanceolate, acute but the very tip rounded, (whitish to) pale pink; coronal filaments in 1 or 2 series, the outer ca. 27–29 in number (N = 2), 10–13 mm long, filiform, the basal portion forming a bowl, the tips spread about 180°, the filaments white in the lower half, pale yellow in the upper half, marked reddish purple adaxially in the lower ⅖; inner corona present and numerous in the flowers of some branches of the type clone but absent in others, absent or only a

few vestigial filaments seen in paratype, 2–3 mm long, capillary, purplish distally, with paler apex; operculum 2.0–3.0 mm long, membranous, plicate, light purple; limen 6–7 mm diam., concave-shallowly funnelform at insertion of androgynophore, very pale greenish yellow, not marked with purple; nectar ring 1 mm high, conspicuously closer to limen edge than base of operculum; staminal filaments connate 7.0–9.5 mm along androgynophore, light greenish yellow at base, paler distally, not marked with purple, the free portions ca. 4 mm long; anthers 3.0–4.8 mm long, not marked with purple, with pale to light yellow pollen; ovary 2.0–4.5 × 1.2–3.0 mm, ellipsoid, 6-ridged, finely and densely (microscopically) puberulent, pink or pale purplish red, or pale yellowish green; styles 5–6 mm long including stigmas, reddish (especially distally); stigmas ca. 2 mm diam., capitate, green. Fruit 7.0 × 2.5 cm, fusiform, 6-ridged, dehiscent, red on ridges, cream between ridges; arils, seeds, and germination type unknown. Chromosome number $2n = 12$.

Distribution and habitat. Known only from the Colombian type and one collection in adjacent Panama, *Passiflora escobariana* is from primary lowland and premontane rainforest, in small to medium-sized trees at edges of light gaps.

Paratypes. COLOMBIA. ANTIOQUIA: cuttings from type collection grown 1989–1992 at Missouri Botanical Garden, *MacDougal et al. 3823GR* (HUA, MO). PANAMA. DARIEN: Parque Nacional Darién, Estación Pirre, a orillas del Río Perresénico entre la Estación Pirre y la cascada, 8°00′N, 77°45′W, 150 m, 10 Oct. 1990 (fl), *H. Herrera 720* (BM, MO, PMA).

Passiflora escobariana is assigned to subgenus *Plectostemma* sect. *Xerogona* (Rafinesque) Killip on account of the plicate floral operculum, lack of extrafloral nectaries, lack of bracts, and dehiscent carinate fruit. It is most similar to *P. rovirosae* and *P. costaricensis* Killip, and shares with them the tendency to form leafless flowering axillary shortshoots. The stem of *P. costaricensis* is always sharply triangular, even 3-winged, and the upper surface of the leaf is hirsute with most trichomes longer than 1 mm; the new species has sub3-, 4-, or 5-angular stems, and the leaves are not hirsute. *Passiflora rovirosae*, from southeastern Mexico to northern Guatemala and Belize, is most similar but has narrower, more densely pubescent, nonbullate leaves with a lateral lobe angle of 22°–30°(–40°), and yellower flowers with a well-developed inner coronal row.

A clone from the type collection was grown in the greenhouses where it flowered a few times a year (mainly in the winter). The species may be self-incompatible: ten controlled self-pollinations failed to set fruit, and no fruit has been produced by autogamy in four years of cultivation. The chromosome count was from *MacDougal et al. 3823GR* (Snow & MacDougal, in press).

The paratype, from Panama, differs from the type in its 4–5-angular stem instead of sub3–4-angular, in having notably longer petioles (4–6 cm vs. 2.5–3.5 cm), and longer trichomes on the upper surface of the leaf (0.2–0.8 mm vs. 0.10–0.25 mm).

It is a privilege to name this passionflower in honor of Linda Albert de Escobar, eminent student of passionflowers, whose valuable work in the genus and on the flora of Colombia is well known.

Acknowledgments. I thank Eldon Leiter for his dogged pursuit and collection of live material of *P. xiikzodz;* his help alone is responsible for most of our understanding of this species. I am also indebted to Joanna Turner for her photographs, observations, and live material of that species from Belize. Victoria Bricker and Anne Bradburn at Tulane University guided the transliteration of the Mayan epithet. Alfred Lau generously collected seed of *P. oaxacensis*, Melvin Turner assisted with *P. juliana*, and Kathy Upton cared for all four of the new taxa in the greenhouse. I thank my Colombian colleagues Diego Restrepo and D. Stella Sylva for guidance during fieldwork in Antioquia, and the curators of the listed herbaria. The Latin diagnoses were graciously polished by Henk van der Werff and William L. Culberson. The initial research on three of these species and fieldwork in Mexico was accomplished during graduate studies at Duke University under a National Science Foundation Fellowship, further supported by NSF grant DEB–7912607.

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New Species of the Fern Genus *Elaphoglossum* from Mesoamerica

John T. Mickel
New York Botanical Garden, Bronx, New York 10458, U.S.A.

ABSTRACT. Of the 118 species of *Elaphoglossum* treated in the flora of Mesoamerica, 33 were determined to be new and are described here. In addition, one new variety is described and one variety is raised to species rank.

Elaphoglossum is a large and taxonomically difficult genus of wet tropical regions. Fée (1845) and Christ (1899) published major treatments of the genus, treating 105 and 142 species, respectively. Today there are thought to be ca. 600 species. Since the turn of the century many additional collections have been made, but until recently there have been no usable treatments for their identification. While preparing a treatment of *Elaphoglossum* for *Flora Mesoamericana*, a number of previously undescribed species were distinguished. Of 118 species in the flora, 33 species and one variety are new, a figure consistent with the recent regional treatments of Mexico (19 new of 45; Mickel, 1980, 1981, 1988, 1992; Smith, 1975), Venezuela (35 new of 101; Mickel, 1985, 1990b, 1991b), and Peru (51 new of 122; Mickel, 1990a, 1991a). Gradually a clearer understanding is emerging of the genus, the species and species groups, and overall character diversity. Several species complexes remain unresolved, and more collections and detailed studies are needed. Most of the species in *Flora Mesoamericana* (all but 11 of the 118) will be treated also in Lellinger's pteridoflora of Costa Rica–Panama–Chocó, together with illustrations.

Elaphoglossum andersonii Mickel, sp. nov.
TYPE: Costa Rica. San José: near Quebradillas, about 7 km N of Santa María de Dota, *Standley 42932* (holotype, US).

Ab *E. hieracioide* frondibus majoribus longius stipitatis textura tenuioribus necnon hydathodiis manifestis abstat.

Epiphytic; rhizome 2–3 mm diam., compact; rhizome scales 3–5 mm long, linear, orange-tan, lustrous, entire; leaves 8–17 cm long, approximate; phyllopodia lacking; petiole ⅖–⅗ the sterile leaf length, tan, flattened; petiole scales 2.5–4 mm long, linear, entire, orange-tan, subulate, spreading, mixed with scattered to dense glandular hairs at petiole base; sterile lamina 4–8 cm long, 1.3–1.7 cm wide, elliptic, chartaceous, base cuneate, apex rounded to acute; veins evident, 2 mm apart, at 45–55° angle to costa; hydathodes evident as orange dots; lamina scales 3–4 mm long, scattered, spreading, subulate, hairlike, orange-tan, entire; fertile leaves shorter than the sterile; petiole ½–¾ the fertile leaf length; fertile lamina elliptic, ca. 2.5 times longer than wide, base and apex rounded; intersporangial scales lacking.

Distribution. Wet forests; 1,500–2,400 m.

Paratypes. COSTA RICA. CARTAGO: Cerro de La Carpintera, *Standley 34327* (US). SAN JOSE: Finca La Cima, above Los Lotes, N of El Copey, *Standley 42659* (US). PANAMA. CHIRIQUI: Bajo Grande, Cerro Punta, *Caballero 178* (US).

This species differs from *E. hieracioides* Mickel in having evident hydathodes, but resembles it in the elongate, longitudinally folded fertile lamina. There seems to be considerable variation in the abundance of glandular hairs, from dense to lacking.

The species is named in honor of William R. Anderson, who completed outstanding studies of *Elaphoglossum* in Hawaii and Jamaica.

Elaphoglossum atrobarbatum Mickel, sp. nov.
TYPE: Panama. Panamá: Cerro Jefe, *Valdespino & Aranda 167* (holotype, NY; isotype, UC).

Frondium squamis longissimis capilliformibus nigris necnon frondibus fertilibus abbreviatis praestans.

Epiphytic; rhizome 3–4 mm diam., compact, horizontal; rhizome scales 4–7 mm long, linear, orange-tan, dull, entire, spreading; leaves 7–20 cm long, approximate; phyllopodia lacking; petiole ⅐–⅖(–½) the sterile leaf length, tan; petiole scales 4–7 mm long, dense, subulate, hairlike, black, lustrous, denticulate, spreading; sterile lamina 5–14 cm long, 1.4–2.3 cm wide, elliptic to lanceolate, chartaceous, base rounded to broadly cuneate, apex acute; veins obscure, at 65° angle to midrib; hydathodes present; lamina scales 4–8 mm long, black, lustrous, denticulate, spreading; fertile leaf shorter than the sterile; petiole ⅔ of fertile leaf length; lamina narrowly elliptic, 6–9 mm wide, broadly cuneate, apex acute to obtuse; intersporangial scales 3–8 mm long, hair-

like, subulate, black, lustrous, inconspicuously sparsely denticulate.

Distribution. Wet forests; 100–1,000 m.

Paratypes. PANAMA. CHIRIQUI: ca. 0.5 km E of Cerro Pate Macho, headwaters of Río Palo Alto, *Knapp et al. 2109* (CR). COCLE: Cerro Gaitel above El Valle, *Miller et al. 788* (MO); Comarca de San Blas, Cerro Obu, *Nevers et al. 8082* (MO). PANAMA: Cerro Jefe, *Stimson 5418* (NY), *Tyson 3599* (MO, TTC), *van der Werff & van Hardeveld 6950* (MO, NY, UC), *Porter et al. 5079* (MO), *Folsom 3836* (MO), *Dressler 3164* (TTC), *Valdespino & Aranda 122* (MO), *211* (MO, NY), *220* (MO, NY), *Churchill 3951A* (MO); headwaters of Río Chagres, Río Esperanza, and Río Piedras, *de Nevers 4073* (MO).

Elaphoglossum atrobarbatum is distinguished by the long, black, hairlike lamina scales and short fertile leaves. It resembles *E. lanceiforme* somewhat in lamina shape, but in *E. atrobarbatum* the scales are longer and are black, rather than orange-brown.

The specific epithet comes from the Latin, *ater*, black, and *barba*, beard, referring to the long, black, subulate laminar scales.

Elaphoglossum auripilum Christ var. **longipilosum** Atehortúa, var. nov. TYPE: Costa Rica. Puntarenas: 5 km S of San Vito de Java, Finca Wilson, *Lloyd 4242* (holotype, NY).

A var. *auripilo* fronde sterili lineari-lanceolato (nec oblanceolato), stipite dense (nec dissite) squamoso, squamis 3–6 mm longis aurantiacis vel rubro-aurantiacis (nec 1–3 mm brunneo-aurantiaco) divisa.

This variety is most readily distinguished from variety *auripilum* by the more abundant, longer scales on petiole (3–6 mm vs. 1–3 mm long) and lamina (2–3 mm vs. 1.5–2 mm long).

Distribution. Wet forests; 1,000–1,800 m.

Paratypes. COSTA RICA. COCOS ISLAND: *Fournier 351* (NY), *Gómez 3347* (NY). PUNTARENAS: San Vito, Finca Wilson, *Lloyd 4226* (NY), *4227* (NY), *Mickel 3098* (NY), *Seidenschnur 131, 132, 135, 161, 185* (all NY), *McAlpin 85-71* (F), *Raven 21966* (F). SAN JOSE: *Gómez et al. 22964* (MO, NY).

Elaphoglossum boquetense Mickel, sp. nov. TYPE: Panama. Chiriquí: Boquete, Cerro Horqueta, *Dwyer & Hayden 7706* (holotype, NY; isotype, MO).

Ab *E. papilloso* laminae stipitisque squamis aurantiacis distat.

Epiphytic; rhizome 4–5 mm diam., compact, horizontal; rhizome scales 1–2 mm long, linear, black, lustrous, slightly denticulate toward apex; leaves 28–40 cm long, approximate; phyllopodia lacking; petiole ⅓–½ of sterile leaf length, tan to brown; petiole scales 1.5–2.5 mm long, sparse, tan (to black at petiole base), entire; sterile lamina 15–25 cm long, 3.4–5 cm wide, elliptic, chartaceous, base attenuate, apex acuminate; veins evident, 2 mm apart, at 60° angle to costa; hydathodes present; lamina scales 2–3 mm long on surface, 3 mm long on margin, scattered on both surfaces, linear, orange-tan, dull, entire; fertile leaf slightly shorter than the sterile; petiole ⅗ of fertile leaf length; fertile lamina elliptic, base attenuate, apex acute; intersporangial scales ca. 1 mm long, rare, orange-tan, linear, dull.

Distribution. Wet forests; 1,500–1,900 m.

Paratypes. PANAMA. CHIRIQUI: vicinity of Fortuna Dam in valley of Río Chiriquí, *Croat 66563* (MO), *Valdespino 1179* (NY).

This species resembles *E. papillosum* (Baker) Christ in lamina shape and white patches, but is distinct in the scattered, orange, petiolar and laminar scales (rather than sparse, minute, black scales).

Elaphoglossum brenesii Mickel, sp. nov. TYPE: Costa Rica. Puntarenas: 5 km S of San Vito de Java, vicinity of Finca Wilson, *Seidenschnur 180* (holotype, NY).

Ab *E. cuspidato* laminae squamis lanceolatis laxe dispositis, costae squamis angustis pallidis et lamina apice acuta divergens.

Epiphytic; rhizome 3–6 mm diam., compact; rhizome scales 3–6 mm long, linear, dark reddish brown, lustrous, ciliate-denticulate; leaves (10–)17–48 cm long, approximate; phyllopodia present, indistinct; petiole ⅛–½ of sterile leaf length, tan to orange; petiole scales 3–7 mm long, dense to scattered, some linear, 3–7 mm long, dark, spreading, most appressed, to 0.5–1 mm long, pale with dark teeth and central streak, lanceolate to orbicular; sterile lamina (8–)13–30 cm long, 1.4–2.5 cm wide, linear-elliptic, chartaceous, base cuneate, apex acuminate; veins obscure, ca. 1 mm apart, at 70° angle to costa; hydathodes lacking; abaxial lamina scales 1–2 mm long, lightly imbricate, some lamina visible, linear-lanceolate, light orange, ciliate-denticulate, with darker point of attachment, costal scales 2–3 mm long, linear, ciliate-denticulate, paler than other laminar scales, with dark teeth and point of attachment, often with dark red-brown lustrous teeth; adaxial scales linear-lanceolate to orbicular, pale orange, costal scales as abaxially; fertile leaves slightly longer than the sterile; petiole ⅗ of fertile leaf length, usually dark; fertile lamina linear-elliptic, base broadly cuneate to rounded, apex acuminate; costal scales 1–1.5 mm long, pale with reddish brown to black

lustrous point of attachment, linear-lanceolate, appressed; intersporangial scales lacking.

Distribution. Wet forests; 500–2,500 m.

Paratypes. COSTA RICA. ALAJUELA: ca. 20 km N of San Ramón, *Moran 3235* (MO); NW end of Finca Los Ensayos, Buena Vista de Zarcero, *Judziewicz 4391* (WIS). CARTAGO: La Estrella, *Standley 39261* (US); Santa María de Dota, 30 mi. S of Cartago, *Stork 2970* (US). GUANACASTE: Parque Rincón de la Vieja, Hacienda Santa María, *Herrera 733* (F, MO, UC); Río Chiquito de Tilarán, *Haber & Bello 5158* (MO). HEREDIA: Virgen del Socorro–Río Sarapiquí–Cariblanco, *Chacón & Herrera 1162* (UC). PUNTARENAS: foothills of the Cordillera de Talamanca, between Agua Caliente and the Río Canasta, *Davidse et al. 28348* (MO). SAN JOSE: ca. 7 km N of San Rafael de Heredia on Volcán Barba, *Lellinger 662* (MO); Pan Amer. Hwy. to San Isidro de General, *Lloyd 4248* (NY). PANAMA. CHIRIQUI: vic. of El Boquete, *Maxon 5034* (US); Distrito de Bugaba, road Volcán–Santa Clara, *van der Werff & Herrera 7058* (MO). COCLE: El Valle Mesa, 5.6 km along mesa road from main road in El Valle, *Folsom 3887* (MO). PANAMA: Distrito Capira, Cerro Campana, *van der Werff & Herrera 6214* (MO). VERAGUAS: between Escuela Agricola Alto Piedra and Río Dos Bocas, *Croat 2589a* (MO).

Elaphoglossum brenesii is distinct from *E. paleaceum* (Hook. & Grev.) Sledge by the dark red central point of attachment of linear-lanceolate scales on costa and often by round, fringed abaxial scales. The former is similar to *E. cuspidatum* (Willd.) T. Moore in the dark-centered laminar scales, but there are some to many abaxial lanceolate scales, the costal ones often very pale with dark teeth.

The species is named in honor of Alberto M. Brenes, collector of plants in the vicinity of San Ramón, Costa Rica.

Elaphoglossum brevissimum Mickel, sp. nov. TYPE: Panama. Panamá: Cerro Jefe, *Valdespino & Aranda 130* (holotype, NY; isotype, MO).

Ab *E. doanensi* frondium fertilium stipite brevissimo differt.

Epiphytic; rhizome 4–5 mm diam., short-creeping; rhizome scales ca. 5 mm long, linear-lanceolate, tan to dark brown mixed together, lustrous, subentire, with an occasional process; leaves 24–37 cm long, 1–2 mm apart; phyllopodia lacking; petiole $\frac{1}{20}$–$\frac{1}{15}$ of sterile leaf length, tan; petiole scales 1–3 mm long, sparse, dark, sclerotic, with processes; sterile lamina 22–35 cm long, 3.5–6.2 cm wide, narrowly elliptic, coriaceous, attenuate at both ends; veins obscure, ca. 1 mm apart, at 80° angle to costa; hydathodes lacking; abaxial lamina surface with scattered minute stellate trichomidia, abaxial costa base with a few scattered scales as on petiole, adaxially glabrous; fertile leaves much shorter than the sterile ($\frac{1}{2}$–$\frac{2}{3}$ the length); petiole $\frac{1}{10}$–$\frac{1}{5}$ the fertile leaf length; fertile lamina 1.2–1.8 cm wide, narrowly elliptic, attenuate at both ends, sparse dark scales on petiole and costa; intersporangial scales lacking.

Distribution. Wet forests; 800–1,000 m.

Paratypes. PANAMA. PANAMA: Cerro Jefe, *Dressler 3163a* (TTC), *3163b* (TTC), *Churchill 3952* (MO), *Tyson 1001* (TTC), *Porter et al. 5078* (MO), *Folsom 3833* (MO), *Moran 3285* (MO), *Croat 43572* (MO), *Valdespino et al. 194* (NY, UC).

This species is similar to *E. doanense* Gómez in the sterile leaf size and short petiole, but that species has large, pale, ovate, appressed petiole scales, pale rhizome scales, longer fertile leaves, and no trichomidia.

The name alludes to the very short petiole.

Elaphoglossum caricifolium Mickel, sp. nov. TYPE: Panama. Chiriquí: Cerro Colorado, 50 km N of San Felix on the Continental Divide, *Mori & Dressler 7890* (holotype, NY).

Ab *E. ciliato* (C. Presl) T. Moore lamina lineari, stipite gracili, phyllopodiis brevibus abstans.

Epiphytic, epipetric, or terrestrial; rhizome 1.2–2 mm diam., short- to moderately creeping, resinous, black, or with scales ca. 1 mm long, linear-lanceolate, sclerotic, lustrous brown, entire; leaves 12–42 cm long, approximate to 2 mm apart; phyllopodia 0.3–0.6 cm long; petiole $\frac{1}{10}$–$\frac{1}{4}$ of sterile leaf length, orange to brown; petiole scales ovate, brown, sclerotic proximally, substellate, orange-tan distally, or lacking, or reduced to resinous dots; sterile lamina 11–35 cm long, 0.5–1.2 cm wide, linear, chartaceous, base and apex attenuate; veins obscure, ca. 1 mm apart, at 65–70° angle to costa; hydathodes lacking; lamina indument adaxially of scales ca. 0.5 mm long, substellate, orange-tan to white with age, more abundant near the margin, abaxial surface with resinous dots, abaxial costa with scattered ovate scales ca. 0.5 mm long; fertile leaves slightly shorter than or equaling the sterile; petiole $\frac{1}{3}$–$\frac{1}{2}$ the fertile leaf length; fertile lamina 4–7 mm wide, linear, attenuate at base and apex, with scattered orange to black, minute (0.2–0.3 mm long) scales adaxially; intersporangial scales lacking.

Distribution. Wet forests; 1,000–2,000 m.

Paratypes. COSTA RICA. ALAJUELA: Monteverde Reserve, Río Penas Blancas, *Bello 979* (MO). GUANACASTE–ALAJUELA: slopes of Miravalles, above Bijagua, *Gómez et al. 19159* (MO, UC). PUNTARENAS: valley of Río Cotón between Sitio Cotón and Sitio Tablas, *Davidse 24472*

(MO); upper slopes of Cerro Burú, *Davidse 23806* (MO). SAN JOSE: vic. of Santa María de Dota, *Standley 43452* (US). PANAMA. BOCAS DEL TORO: Oleoducto Road, 2 km NE of Continental Divide, *Churchill et al. 4934* (MO). CHIRIQUI: El Respingo, Cerro Punta, *Chavarría 38* (US); Fortuna, *Correa et al. 2179* (US); Cerro Colorado, 50 km N of San Felix on Continental Divide, *Mori & Dressler 7890* (US); El Boquete, *Cornman 853* (UC, US); end of road past Palo Alto, ca. 4.5 mi. NE of Boquete, *Hammel 7358* (MO); Cerro Hornito, *Croat 67973* (UC); E of main camp at dam site, *Folsom et al. 5461* (UC); Distrito de Bugaba, Santa Clara, *van der Werff & Herrera 7172* (MO, NY, UC). VERAGUAS: Cerro Tute, *Thompson et al. 8850* (MO).

Elaphoglossum caricifolium is distinguished by the slender, naked to resinous-scaly rhizome, linear lamina, and short phyllopodia, but is variable in the scaliness of the rhizome and leaf.

The name refers to the sedgelike leaves.

Elaphoglossum caroliae Mickel, sp. nov. TYPE: Costa Rica. Volcán Barba, 7,800 ft., *Lloyd 4138* (holotype, NY).

Ab *E. smithii* (Baker) Christ lamina latiori basi rotundata differt.

Epiphytic; rhizome 4–6 mm diam., compact; rhizome scales 4–5 mm long, lanceolate, reddish brown to red-orange, lustrous, denticulate, spreading; leaves 10–33 cm long, approximate; phyllopodia lacking; petiole ½–⅔ the sterile leaf length, stramineous; petiole scales 3–4 mm long, scattered to dense, lanceolate to subulate, orange, dull, denticulate, spreading; sterile lamina (4–)7–14 cm long, 2–5 cm wide, lanceolate, chartaceous, base rounded, apex caudate; lamina scales ca. 5 mm long on costa, 2–3 mm long on margin, sparse to rare, subulate, orange, dull, spreading; veins evident, 1.5–2 mm apart, at 70° angle to costa; hydathodes present; fertile leaves shorter than the sterile; petiole ¾ the fertile leaf length; fertile lamina lanceolate, base rounded, apex acute to mucronate; abaxial costa glabrous or with scales 3–5 mm long, scattered, linear, hairlike; intersporangial scales 2 mm, orange-tan, hairlike, or lacking.

Distribution. Wet forests; 1,200–2,600 m.

Paratypes. COSTA RICA. CARTAGO: La Carpintera, *Torres 120* (US), *Standley 34433* (US); Santa Clara de Cartago, *Lankester 898* (US); San Cristóbal–El Tejar road, *Stork 2236* (UC). HEREDIA: Cerros de Zurquí, NE of San Isidro, *Standley & Valerio 50361* (US). SAN JOSE: ca. 10 km N of San Rafael de Heredia on Volcán Barba, *Mickel 2656* (NY), *2677* (NY), *3023* (NY); Volcán Barba, *Brade 545* (NY), *Lloyd 4140b* (NY); San Cristóbal road, *Danielson* (*Stork no. 2545*) (UC, MICH). LIMON: Cordillera de Talamanca, Cerros Tararia (Tres Picos), *Davidse et al. 28796A* (MO). PANAMA. Cerro Tute, *Thompson et al. 8850* (MO).

Elaphoglossum caroliae is distinguished by the orange scales of the rhizome and leaf, lustrous laminar surface, and rounded lamina base. There is considerable variation in the abundance of scales on the petiole and lamina, and even among the sporangia.

The species is named in honor of my wife, Carol J. Mickel.

Elaphoglossum christianeae Mickel, sp. nov. TYPE: Panama. Panamá: 4.5 km N of Lago Cerro Azul by road, *Nee 7040* (holotype, NY; isotypes, MO, UC).

Rhizomatis squamis elongatis aurantiacis, laminae squamis sparsis dissectis aurantiacis praestans.

Epiphytic, rarely epipetric; rhizome 4–6 mm diam., compact; rhizome scales 7–13 mm long, linear-lanceolate, orange-tan, dull, entire with occasional hairlike processes; leaves 10–32 cm long, approximate; phyllopodia present; petiole 1/15–1/5 (1–3 cm) of sterile leaf length, stramineous to tan; petiole scales 1–2 mm long, scattered, spreading, linear, lacerated with narrow processes, orange to brownish black, dull; sterile lamina 10–29 cm long, 1.4–1.8 cm wide, narrowly elliptic, coriaceous, base attenuate, apex acuminate; veins obscure, ca. 0.8 mm apart, at 75° angle to costa; hydathodes lacking; lamina scales 1 mm, scattered (dense at base) on costa and lamina, deciduous on adaxial surface, highly dissected, substellate, orange, dull; fertile leaves longer or shorter than the sterile; petiole ⅓ the fertile leaf length; fertile lamina linear-elliptic, ½ as broad as the sterile; intersporangial scales lacking.

Distribution. Wet forests; 0–700 m.

Paratypes. COSTA RICA. PUNTARENAS: Osa Peninsula, 9 km N of Rincón de Osa lumber camp, *Lloyd 4154* (NY), *4256* (NY); top of ridge just N of OTS station, *Lloyd 4164* (NY); ridge W of Rincón de Osa, *Seidenschnur 57b* (NY), *60* (NY), *61* (NY); at OTS field station, *Seidenschnur 103* (NY), *117* (NY); near airfield, ca. 4 mi. W of Rincón de Osa, *Burger & Stolze 5484* (F). PANAMA. CANAL ZONE: near Madden Dam, *Alston 8903* (CR). DARIEN: Parque Nacional del Darién, Estación Rancho Frío at N base of Cerro Pirre, *de Nevers et al. 8262* (MO). PANAMA: Río La Maestra, *Allen 39* (US).

This species is distingished by the long, orange rhizome scales and the slender lamina with scattered, orange, highly dissected abaxial scales.

The species is named in honor of Christiane S. Anderson, who made many valuable collections of *Elaphoglossum* in Costa Rica and who co-authored the treatment of that genus for Jamaica.

Elaphoglossum cocosense Mickel, sp. nov. TYPE: Costa Rica. Iles Cocos, *Pittier 12359* (holotype, US; isotype, US).

Ab *E. paleaceo* frondibus magnis basi longe attenuatis necnon squamis rhizomatis, stipitis laminaeque magnis, tenuibus et sparsim longidentatis distat.

Epiphytic; rhizome ca. 5 mm diam., compact; rhizome scales 7–12 mm long, linear-lanceolate, orange-tan to blackish, thin, margin with sparse, very long (to 1 mm long) hair-teeth; leaves 37–65 cm long, approximate; phyllopodia present; petiole 1/10–1/5 the sterile leaf length, orange-tan, densely clothed with orange-tan scales 4–8 mm long, sparsely long-hair-toothed; sterile lamina 36–50 cm long, (2.4–)3.0–4.0 cm wide, narrowly oblanceolate, chartaceous, base gradually long-attenuate, apex cuspidate; veins obscure, ca. 1 mm apart, at ca. 70° angle to costa; hydathodes lacking; lamina scales abaxially 3–6 mm long, abundant, imbricate, linear-lanceolate, long hair-toothed, adaxially mostly 2–3 mm long, to glabrescent; fertile leaves not seen.

Distribution. Wet forests; "middle elevation."

Paratypes. COSTA RICA. COCOS ISLAND: *Gómez 3327* (CR, F, US), *3362* (CR, NY, US), *Klawe*, 3 Sep. 1967 (US), *Valerio 1095* (CR).

This resembles *E. paleaceum* in the linear-lanceolate scales on both laminar surfaces, but is distinct in the more dissected blade and petiole scales, the large leaf size, the long-attenuate lamina base, the very long, slender petiole scales, and the rhizome scales thin, only sparsely toothed.

Elaphoglossum coriifolium Mickel, sp. nov. TYPE: Panama. Chiriquí: Distrito Bugaba, Cerro Punta, *van der Werff & Herrera 6317* (holotype, MO; isotypes, NY, UC).

Ab *E. lingua* foliis magnis et lamina basi truncata differt.

Epiphytic or terrestrial; rhizome 4–5 mm diam., creeping; rhizome scales 4–6 mm long, lanceolate, dark reddish brown, lustrous, entire; leaves 49–60 cm long, 1–2.5 cm distant; phyllopodia present; petiole 1/2 the leaf length, brown; scales at petiole base 5–10 mm long, scattered, orange, spreading, with hairlike processes, scales distally reduced, obscure, finely skeletonized, appressed; sterile lamina 22–29 cm long, 7–10 cm wide, broadly lanceolate, coriaceous, base truncate to broadly cuneate, apex acute to rounded; veins obscure, 0.7–0.9 mm apart, at 75–80° angle to costa; hydathodes lacking; lamina scales lacking except for minute, stellate, black to dark orange trichomidia; fertile leaves slightly longer than the sterile; petiole 3/4 the fertile leaf length; fertile lamina similar in shape to the sterile but 1/3–1/2 as wide; intersporangial scales lacking.

Distribution. Wet forests; 1,800–2,300 m.

Paratypes. COSTA RICA. SAN JOSE: Desamparados, Frailes, C. Abejonales, *Chavarría & Herrera 25* (CR, MO). PUNTARENAS: upper Río Burú, *Gómez et al. 21527* (CR, MO); San Isidro, La Guaba, *Jiménez 303* (CR); Cerro Chompipe, near Ermita Sta. Cruz, *Lems 650202* (NY). PANAMA. CHIRIQUI: Monte Azul, 1.4 mi. N of Entre Ríos on E slopes of Cerro Punta, *Antonio 2724* (MO); above Boquete, on trail to Pate Macho, *McPherson 1231F* (MO); vic. of Guadalupe, between Río Chiriquí Viejo and the Continental Divide, *Churchill & de Nevers 5054* (MO); Distrito Bugaba, Cerro Punta, *van der Werff & Herrera 6274* (MO).

Elaphoglossum coriifolium is distinguished by the creeping rhizome, large, strongly coriaceous, truncate blade, and stellate trichomidia. It is related to *E. lingua* (C. Presl) Brackenr. but is the largest form in that complex, resembling it in the roughly ovate or lanceolate, heavily coriaceous lamina, rounded blade apex, fertile leaf longer than the sterile, and small, black, semideciduous rhizome scales.

Antonio 2724 is similar in rhizome diameter and habit and the broadly cuneate blade base but has thinner blade texture, more pointed narrower fertile lamina, and the rhizome scales are not sclerotic. This may represent a distinct taxon.

The specific epithet comes from the Latin, *corium*, leather, and *folia*, leaf, referring to the highly coriaceous leaves.

Elaphoglossum correae Mickel, sp. nov. TYPE: Costa Rica. Finca La Selva, *Lloyd 4284* (holotype, NY).

Elaphoglosso producto Rosenstock affinis, sed stipite gracili, lamina lineari-elliptica, fronde fertili iis sterilibus multo breviori, lamina fertili lanceolata, ulterius patria in regione inferiori abstans.

Epiphytic; rhizome 2–4 mm diam., compact; rhizome scales 4–5 mm long, linear, tan at base, blackish at tip, lustrous, subentire, with occasional processes; leaves 18–48 cm long, approximate; phyllopodia present; petiole 1/8–1/3 the sterile leaf length, tan; petiole scales 2 mm long, sparse, blackish, lustrous, linear-lanceolate, spreading, and appressed, scattered, orange trichomidia; sterile lamina 13–36 cm long, 1.2–2.1 cm wide, linear-elliptic, subcoriaceous, attenuate at both ends; veins obscure, 1 mm apart, at 70° angle to costa; hydathodes lacking; laminar scales 0.5–1 mm long, abaxially scattered, linear, hastate or with irregular processes, brown to black, lustrous, especially toward the lam-

ina base and costa, adaxially glabrous; fertile leaves much shorter than the sterile (⅕–½ the sterile), petiole ca. ⅖ the fertile leaf length; fertile lamina 1.0–2.1 cm wide, lanceolate, base rounded to truncate, apex acuminate, black scales on petiole and costa as on sterile leaves linear to arachnidoid (spiderlike); intersporangial scales lacking.

Distribution. Wet forests; 80–350 m.

Paratypes. COSTA RICA. ALAJUELA: Cordillera de Tilarán, road between San Ramón and Bajo Rodriguez, *Croat 68167* (MO), *68183* (MO); Upala, Dos Ríos, 5 km al sur de Brasilia, *Herrera 1023* (UC). HEREDIA: Cerros Sardinal, *Smith 1790* (CR, MO, UC). PANAMA. COLON: Santa Rita Ridge Rd., *Sytsma 1347* (CR). SAN BLAS: Continental Divide along El Llano–Carti Road, Nusagandi, *de Nevers & Pérez 3711* (MO). PANAMA: Cerro Jefe, *Dressler 3072* (TTC), *3073* (TTC), *Correa & Dressler 189* (TTC), *190* (TTC). SAN JOSE ISLAND: *Johnston 205* (GH).

Elaphoglossum correae is distinguished by the slender sterile leaves and broader, much shorter fertile leaves, tan-based black-tipped rhizome scales, and occurrence at low elevation.

The species is named in honor of Mireya D. Correa A., outstanding taxonomist and teacher in Panama.

Elaphoglossum croatii Mickel, sp. nov. TYPE: Panama. Chiriquí: Distrito Boquete, Fortuna dam site, *van der Werff & van Hardeveld 6728* (holotype, NY; isotypes, MO, UC).

Ab *E. biolleyi* stipite gracili, rhizomatis compactioris squamis linearibus abstans.

Epiphytic; rhizome 4–6 mm diam., compact to short-creeping; rhizome scales 3–4 mm long, lanceolate–deltate, dark brown, lustrous, entire; leaves 25–38 cm long, approximate; phyllopodia present; petiole 1/10–⅕ of sterile leaf length, tan to brown; petiole scales 1–3 mm long, sparse, spreading, dark brown, lustrous as on rhizome, and squamules/trichomidia less than 0.5 mm long, round to stellate, appressed, orange to brown; sterile lamina 21–32 cm long, 3.3–4.5 cm wide, elliptic, chartaceous, attenuate at both ends; veins evident, 1–1.5 mm apart, at 80° angle to costa, indistinctly united at margin to form a commissural vein; hydathodes lacking; lamina abaxially with scattered stellate trichomidia, 0.1–0.3 mm long, brown, adaxially glabrous; fertile leaves about equal to or slightly longer than the sterile; petiole ca. ½ of fertile leaf length; fertile lamina 1–2.7 cm wide, narrowly elliptic, attenuate at both ends; intersporangial scales lacking.

Distribution. Wet forests; 800–1,200(–1,700) m.

Paratypes. COSTA RICA. CARTAGO: above San Isidro, *Weber 6013* (GH). SAN JOSE: ca. 15 km N of Tres Ríos, *Lellinger 1384* (MICH). PANAMA. BOCAS DEL TORO: Fortuna Dam area, *Churchill 5862* (MO). CHIRIQUI: Distrito Boquete, Fortuna Dam site, *van der Werff & van Hardeveld 6693* (UC), *van der Werff 6888* (MO); NO de Fortuna, *Correa et al. 2579* (US). COCLE: La Mesa above El Valle, junction with road to Cerro Pilón, *Croat 25337* (MO).

Elaphoglossum croatii is distinct from *E. latifolium* (Sw.) J. Smith by the presence of dark, entire rhizome scales (also scattered on petiole), the presence of laminar trichomidia, and thinner texture.

This species is named in honor of Thomas B. Croat, exceptional collector of plants in tropical America.

Elaphoglossum davidsei Mickel, sp. nov. TYPE: Costa Rica. Limón: Valle de Silencio, N of Cerro Hoffman, *Davidse et al. 28653* (holotype, NY; isotype, MO).

Ab *E. alfredii* rhizomatis squamis deltatis appressis sparsis differt.

Terrestrial, rarely epiphytic; rhizome 2.5–4 mm diam., creeping; rhizome scales mostly 1–1.5 mm long, brown, deltate, dull to somewhat lustrous, entire to short-toothed, appressed; leaves 11–28 cm long, 2–10 mm apart; phyllopodia lacking; petiole 1/10–⅙ the sterile leaf length, tan to brown; petiole scales 0.5–1.5 mm long, deltate to lanceolate, brown, dull, entire, appressed or tips spreading; sterile lamina 9–25 cm long, 1.1–2.1 cm wide, narrowly elliptic, chartaceous; base cuneate, apex attenuate; veins evident, ca. 2 mm apart, at 60° angle to costa; hydathodes present; lamina scales evenly and sparsely distributed on surfaces and margin, lamina also with round punctae 0.1 mm or lanceolate scales 0.8 mm, these dull brown, the longer ones with darker lustrous apex, entire or minutely and sparsely toothed; fertile leaves slightly shorter to slightly longer than the sterile; petiole ⅔–⅘ the fertile leaf length; fertile lamina 5.5–9 cm long, 1–1.5 cm wide, base broadly cuneate, apex acute to acuminate; adaxial scales 0.1–0.2 mm long, black, lustrous, deltate, intersporangial scales lacking.

Distribution. Wet forests; 2,300–3,100 m.

Paratypes. COSTA RICA. CARTAGO: 16 km SE of El Empalme, *Smith 2103* (CR, MO, NY, UC); near La Chonta, *Scamman & Holdridge 8022* (GH, US). LIMON: between Río Terbi and Río Siní, *Davidse et al. 28936* (MO, UC). PUNTARENAS–LIMON BORDER: between Cerro Kasir and Cerro Nai, *Davidse et al. 25843* (CR). SAN JOSE/CARTAGO: 22 km SE of Empalme, *Burger & Liesner 6489* (US). PANAMA. BOCAS DEL TORO: 2–5 km NW of peak of Cerro Echandí, *Davidse et al. 25085* (MO), *25479* (MO, UC), *Gómez et al. 22259* (MO, UC).

Elaphoglossum davidsei is a good match for *E. alfredii* Rosenstock in all dimensions but has rhizome scales that are deltate, appressed, and scattered.

The species is named in honor of Gerrit Davidse, who has made many interesting collections of *Elaphoglossum*.

Elaphoglossum eximiiforme Mickel, sp. nov. TYPE: Panama. SE slopes of Cerro Echandí, Bocas del Toro, *Gómez et al. 22284* (holotype, NY; isotype, MO).

Ab *E. eximio* stipite longiori et laminae squamis longioribus crebrioribus diversa.

Epiphytic; rhizome 2–3 mm diam., compact; rhizome scales 4–7 mm long, linear, reddish brown, lustrous, denticulate; leaves 25–33 cm long, approximate; phyllopodia lacking; petiole ⅓–⅕ of sterile leaf length, tan; petiole scales 2–2.5 mm long, scattered, spreading, subulate, orange-tan, lustrous, denticulate, many 3–5-celled hairs also present; sterile lamina 15–22 cm long, 1.1–2.1 cm wide, linear-lanceolate, chartaceous, base broadly cuneate, apex acuminate; veins evident, mostly simple, a few once-forked, 1.2–1.8 mm apart, at 65° angle to costa; hydathodes present; blade scales 2–3 mm long, scattered, ascending, subulate, orange-tan, dull, denticulate; fertile leaves shorter than to nearly equaling the sterile; petiole ⅔ the fertile leaf length; lamina linear-lanceolate, base broadly cuneate, apex acuminate; intersporangial scales 1.5–2.5 mm long, dense, linear-lanceolate, dark reddish brown, lustrous, denticulate.

Distribution. Wet forests; 2,600–2,800 m.

Paratypes. COSTA RICA. CARTAGO: Volcán de Turrialba, *Pittier 7492* (NY, US).

This species differs from *E. eximium* (Mett.) Christ in the longer petiole and longer laminar scales.

Elaphoglossum fuliginosum Mickel, sp. nov. TYPE: Costa Rica. San José: ca. 3 km NW of Cascajal near the union of the Cascajal and Bajo Maquina rivers, *Taylor & Taylor 11339* (holotype, NY).

Ab *E. muscoso* laminae squamis parvis sparsis nigris absimilis.

Epiphytic; rhizome 4–6 mm diam., compact; rhizome scales 5–10 mm long, linear, black to brown, lustrous, subentire, occasionally with slight teeth; leaves 10–30 cm long, approximate; phyllopodia present, obscured by dense scales at petiole base; petiole ⅖ the sterile leaf length, tan-orange; petiole scales 2–5 mm long, scattered to dense, lanceolate, black, especially the center, distally the petiole scales all black, lustrous, erose, spreading, smaller ones 0.6–1.5 mm long, short-ciliate-denticulate, appressed; sterile lamina 6–17 cm long, 1.8–3.8 cm wide, oblong, coriaceous, base broadly cuneate, apex obtuse; veins obscure, ca. 1 mm apart, at 75° angle to costa; hydathodes lacking; lamina scales 0.7–1.5 mm long, abaxially scattered, appressed, lanceolate, black to mottled black especially near lamina margin, with black cell contents and clear walls, denticulate to short-ciliate, slightly arched, adaxially orbicular, peltate, white, scattered, entire; fertile leaves longer than the sterile; petiole ¾ the fertile leaf length; fertile lamina narrowly elliptic, base broadly cuneate, apex acute to obtuse; costal scales ca. 1 mm long, black, appressed, dense; intersporangial scales ca. 1 mm long, scattered, black, lustrous, denticulate.

Distribution. Wet forests; 1,700–2,400 m.

Paratypes. COSTA RICA. CARTAGO: near Empalme, *Brown CR-64* (US). LIMON: Valle de Silencio, along the Río Terbi, *Davidse et al. 28783* (CR, MO); ca. 1 km S of El Empalme along Interamerican Hwy., *Lellinger 1200* (F). SAN JOSE: ca. 3 km NW of Cascajal, *Taylor & Taylor 11338* (US); S of Cartago, ca. 4 km S of El Empalme, near La Chonta, *Lellinger 1200* (US), *1604* (US). PROV. UNKNOWN: vic. of Coliblanco, *Maxon 281* (NY, US).

Elaphoglossum fuliginosum differs from *E. muscosum* (Sw.) T. Moore by the small, sparse, black laminar scales.

The specific epithet derives from the Latin, *fuligio*, soot, alluding to the black lamina scales.

Elaphoglossum gloeorrhizum Mickel, sp. nov. TYPE: Costa Rica. Volcán Barba, *Lloyd 4140a* (holotype, NY).

Rhizomate crasso nudo glutinoso, stipite forti, necnon lamina eximie coriacea notabilis.

Epiphytic, rarely terrestrial; rhizome 5–9 mm diam., short-creeping, resinous, black; rhizome scales lacking; leaves 35–53 cm long, approximate to 5 mm apart; phyllopodia 1.5–3(–4) cm long; petiole ¼–½ of sterile leaf length, orange-tan (to brown), lacking scales but with resinous dots at base, rarely with a few minute (1-mm-long) brown scales near base; sterile lamina 21–40 cm long, 2.3–4.6 cm wide, narrowly elliptic, strongly coriaceous, base cuneate, apex attenuate; veins obscure, 1 mm apart, at ca. 75° angle to costa; hydathodes lacking; lamina glabrous or with very obscure minute dots on abaxial surface; fertile leaves about same length as the sterile

leaves; petiole ⅓–½ of fertile leaf length; fertile lamina 1–3.4 cm wide, narrowly elliptic, base cuneate, apex attenuate, lacking indument.

Distribution. Wet forests; 1,800–2,700 m.

Paratypes. HONDURAS. OCOTEPEQUE: Aldea El Portín, Agua Caliente–Sta. Rosa de Copán, *Croat & Hannon 63800* (MO). COSTA RICA. LIMON: Cordillera de Talamanca, Valle de Silencio, along Río Terbi, *Davidse et al. 28972* (MO); Cordillera de Talamanca, S side of cordillera between Río Terbi and Río Siní, *Davidse et al. 28972* (MO); Varablanca, *Lloyd 4124* (NY); region of Zarcero, *Smith H104* (F, MO); *Wercklé*, in 1910 (NY, UC).

This species is distinguished by the thick, naked, resinous rhizome, stout petiole, and coriaceous lamina.

The specific epithet derives from the Greek, *gloios*, glue, and *rhiza*, root, for the black, resinous rhizome.

Elaphoglossum grayumii Mickel, sp. nov. TYPE: Costa Rica. Puntarenas: 5 km S of San Vito, Finca Wilson, *Mickel 3066* (holotype, NY).

Ab *E. eximio* hydathodiis nullis, costae squamis fuscis processibus provisis, phyllopodiis, necnon lamina fertili basin versus attenuata absimilis.

Epiphytic; rhizome 3–4 mm diam., compact to short-creeping; rhizome scales 1–2 mm long, linear, black, rarely orange-tan, touched with black, lustrous, entire; leaves 32–40 cm long, approximate to 6 mm apart; phyllopodia present; petiole less than $\frac{1}{15}$ the sterile leaf length (1–2 cm long), essentially lacking, stramineous to tan; petiole scales at petiole base 1–2 mm long, sparse, appressed, lanceolate to linear, brown to black, lustrous, entire to occasionally toothed, distally with stellate scales to trichomidia less than 0.5 mm long; sterile lamina 30–38 cm long, 1.7–3.0 cm wide, linear-elliptic, coriaceous, base attenuate, apex acuminate; veins obscure, ca. 1 mm apart, at 75° angle to costa, uniting at margin to form commissural vein; hydathodes lacking; scales on costa sparse, linear to lanceolate, black, lustrous, ca. 1 mm long, irregularly lobulate, laminar scales reduced to 0.3–0.8 mm stellate hairs or 0.1 mm punctae; fertile leaves slightly shorter than the sterile; petiole ⅔–½ the fertile leaf length; fertile lamina narrowly elliptic, attenuate at both ends; intersporangial scales lacking.

Distribution. Wet forests; 100–2,000 m.

Paratypes. HONDURAS. Santa Cruz de Yojoa, Cortes, *Edwards 721* (F). NICARAGUA. ZELAYA: Cerro La Pimienta, *Pipoly 5243* (CR, UC); Cano El Hormiguerro, *Pipoly 5926* (CR, MO); Costado SW of Cerro El Hormiguerro, *Grijalva 488* (UC, US); ca. 6 km N of Colonia San Antonio on new road to Colonia San Martín, *Stevens 9015* (UC). COSTA RICA. ALAJUELA: ca. 20 km SW of San Ramón, *Smith 2254* (CR, UC); between San Ramón and Bajo Rodriguez, *Croat 68181* (MO, UC). CARTAGO: SE of bridge over Río Pacuare, *Lent 670* (F). HEREDIA: Cerros Sardinal, ca. 2–2.5 km N of Chilamate de Sarapiquí, *Smith 1791* (CR, NY, UC); Finca La Selva, *Grayum 1964* (NY). LIMON: vic. of Guápiles, *Standley 37070* (US). PUNTARENAS: San Vito, W of Finca Wilson, *Lloyd 4223* (NY); Osa Peninsula, Tropical Science Center field station, *Seidenschnur 119* (NY); Boruca, *Ocampo 1340* (CR). SAN JOSE: basin of El General, *Skutch 2158* (MO, NY, UC). PANAMA. CANAL ZONE: Barro Colorado Island, *Croat 10996* (MO). CHIRIQUI: 2.5 km from Questa Piedra along Río Monte Road, *Folsom 3981* (MO, UC). COCLE: foot of Cerro Pilón, above El Valle de Antón, *Porter et al. 4666* (MO, NY).

Elaphoglossum grayumii differs from *E. eximium* (Mett.) Christ in lacking hydathodes, and by the presence of dark costal scales (with lateral processes), phyllopodia, and fertile lamina attenuate at the base.

The species is named in honor of Michael H. Grayum, collector and student of the Costa Rican flora.

Elaphoglossum heterochroum Mickel, sp. nov. TYPE: Costa Rica. Región sureste del Lago Dabagri, *Gómez et al. 23217* (holotype, NY; isotype, MO).

Inter *E. cuspidatum* et *E. paleaceum* quasi intermedia, a prima stipitis costaeque squamis ad mediam nigro-purpureis, laminae squamis lanceolatis arcuatis aurantiacis laxe dispositis diversa.

Epiphytic; rhizome 3–4 mm diam., compact; rhizome scales 4–5 mm long, linear, castaneous, lustrous, margin with sparse stiff cilia often abraded so as to appear entire; leaves 24–35 cm long, approximate; phyllopodia present; petiole, ⅕–⅓ the sterile leaf length, tan to orange; petiole scales 1–3 mm long, dense, spreading, linear-lanceolate, castaneous to black-lustrous, distally on petiole scales with dark center and pale margin, ciliate-denticulate; sterile lamina 18–24 cm long, 1.2–2.1 cm wide, linear-elliptic, coriaceous, base cuneate, apex acuminate; veins obscure, ca. 1 mm apart, at 80–85° angle to costa; hydathodes lacking; lamina scales 1–2 mm long, dense, appressed, lanceolate, pale, dull, ciliate-denticulate, costal scales black-centered, adaxially subimbricate to very sparse or lacking, lanceolate to suborbicular, whitish; fertile leaves longer than the sterile; petiole ⅓–⅔ the fertile leaf length; fertile lamina linear, base broadly cuneate, apex acuminate; costal scales black, appressed, suborbicular, ciliate-denticulate, adaxially denser than on sterile lamina, suborbicular; intersporangial scales lacking.

Distribution. Wet forests; 600–2,900 m.

Paratypes. COSTA RICA. ALAJUELA: N side of Volcán Arenal, *Lent 2921* (F); 8 mi. NW of San Ramón on road to Tilarán, *Lloyd 4194* (NY). CARTAGO: near Río Pejibaye, 2 km SW of Taus, *Lent 2971* (F). LIMON: ridge between Quebrada Camagre and Río Barbilla, *Grayum 8904* (MO); between headwaters of Río Madre de Dios and Quebrada Barreal, *Grayum 8802* (MO). HEREDIA: Virgen del Socorro–Río Sarapiquí–Cariblanco, *Chacón & Herrera 1162* (MO). PUNTARENAS: just N of Santa Elena on Fila Cotón, S of Agua Caliente, *Davidse et al. 28273* (MO). PANAMA. COCLE: La Mesa above El Valle, *Folsom 5629* (MO, UC); foot of Cerro Pilón, above El Valle de Antón, *Porter et al. 4662* (MO, NY); 9.4 km above El Copé, *Croat 44657* (MO). DARIEN: Pirre Massif, Alturas de Nique, *McPherson 12202C* (MO). PANAMA: Distrito Capira, Cerro Campana, *van der Werff & Herrera 6214* (NY, UC), *Porter et al. 4939* (MO, UC).

Elaphoglossum heterochroum resembles both *E. cuspidatum* and *E. paleaceum*, but the scales of the petiole and costa are blackish at the center, the lamina scales are imbricate, lanceolate, orange, and the rhizome scales castaneous. It is close to *E. nigrocostatum* Mickel of Venezuela, but differs in the bicolorous costal and petiolar scales.

The specific epithet comes from the Greek, *heteros*, other, *chroma*, color, referring to the bicolorous petiolar and costal scales.

Elaphoglossum killipii Mickel, sp. nov. TYPE: Costa Rica. San José: vic. of Santa María de Dota, *Standley 41625* (holotype, US).

Proxime ad *E. longicrurem* accedens, sed frondibus majoribus rhizomatisque squamis bicoloribus absimilis.

Epiphytic; rhizome 2.5–4 mm diam., compact to short-creeping; rhizome scales 2–4 mm long, linear-lanceolate, bicolorous, castaneous to black-centered with orange-tan margin, entire; leaves (14–)26–46 cm long, approximate to 2 mm apart; phyllopodia distinct; petiole ⅕–⅓ the sterile leaf length, glabrous to sparsely scaly; petiole scales 3–5 mm long, lanceolate, lustrous, bicolorous as on rhizome, entire; lamina (15–)20–32 cm long, (1.5–)2.0–3.4 cm wide, narrowly oblanceolate to elliptic, coriaceous, gradually attenuate at base, apex acute to acuminate; veins obscure, ca. 1 mm apart, at 60–70° angle to costa; hydathodes lacking; blade surfaces glabrous or with very sparse minute stellate trichomidia on abaxial surface and often with a few lanceolate scales on base of abaxial costa; fertile leaves slightly longer than the sterile; petiole ½–⅔ of fertile leaf length; fertile lamina slightly narrower than the sterile, base attenuate, acute to rounded; intersporangial scales lacking.

Distribution. Wet forests; 1,000–2,000 m.

Paratypes. COSTA RICA. PUNTARENAS: valley of the Río Cotón between Sitio Cotón and Sitio Tablas, *Davidse 24452* (CR, MO); Upper Río Burú, *Gómez et al. 21487* (MO). SAN JOSE: Quebrada de los Yases, entre La Guaria y Palmilera, Dota, *Jiménez 1455* (CR, NY); Alto del Sacatal, *Pittier* (herb. no. 10536) (CR). PANAMA. CHIRIQUI: slopes of Cerro de Lino, above El Boquete, *Maxon 5213* (US); vic. of Boquete, *Cornman 853* (ARIZ), *895* (ARIZ), *897* (ARIZ), *1014* (ARIZ, US), *Killip 5180* (US), *5203* (US), *Maxon 5032* (US); lower slopes of Cerro Pelota, *Knapp 1491* (CR).

Elaphoglossum killipii closely resembles *E. longicrure* Christ, differing in its larger size and bicolorous rhizome scales.

The species is named in honor of Ellsworth P. Killip, whose avid collecting has contributed greatly to our knowledge of Central American pteridophytes.

Elaphoglossum lanceiforme Mickel, sp. nov. TYPE: Costa Rica. Los Angeles de San Ramón, *Brenes 16141* (holotype, NY).

Ab *E. setoso* (Liebm.) T. Moore lamina lanceolata majori, stipitis laminaeque squamis longioribus, necnon lamina fertili angusta diversa.

Epiphytic; rhizome 2–4 mm diam., compact; rhizome scales 3–5 mm long, linear-lanceolate, dark reddish brown, lustrous, entire, appressed; leaves 11–30 cm long, approximate; phyllopodia present; petiole ⅓ the sterile leaf length, tan; petiole scales 2–4 mm long, abundant, subulate, dark reddish brown, lustrous, denticulate, spreading; sterile lamina 8–19 cm long, 1.8–3.2 cm wide, linear-lanceolate, chartaceous, base broadly cuneate to rounded, apex acuminate; lamina scales 1–5 mm, scattered, hairlike, subulate, dark reddish brown, lustrous, the longer ones on costa and margin, denticulate, spreading; veins evident, 1.5–2 mm apart, at ca. 70° angle to costa; hydathodes present; fertile leaves shorter than the sterile; petiole ⅔ the fertile leaf length; fertile lamina 6.5–9 cm long, 0.8–11 cm wide, linear to linear-lanceolate, base cuneate, apex acuminate; intersporangial scales 3–5 mm long, abundant, hairlike, orange-tan to dark reddish brown, lustrous, remotely and indistinctly denticulate.

Distribution. Wet forests; 800–1,500(–2000) m.

Paratypes. COSTA RICA. ALAJUELA: ca. 23 km NE of San Ramón, *Taylor 17846* (NY); 8 mi. NW of San Ramón on road to Tilarán, *Lloyd 4193* (NY). CARTAGO: Reserva de Tapantí, *Gómez 18919* (MO, UC). HEREDIA: between Río Peje and Río Sardinalito, *Grayum 6666* (MO); Laguna del Barva and summit of Volcán Barva, *Grayum & Quesada 7432* (UC). SAN JOSE: near km 50 along Pan American Hwy., Cerro de la Muerte, *Seidenschnur 232* (NY); along Río Zurquí, *Smith 1709* (UC); Alto La Palma, NW of San José, *Moran 2352* (MO); vic. of La Palma, *Maxon*

& Harvey 7907 (US); La Hondura, *Standley 3791* (US); Parque Nacional Braulio-Carrillo, *Moran 3265* (NY). PUNTARENAS: 5 km S of San Vito, Finca Wilson, *Mickel 3132* (NY); Monteverde, *Palmer 62* (NY). PANAMA. BOCAS DEL TORO: Fortuna Dam–Chiriquí Grande road, *McPherson 6792* (MO). CHIRIQUI: Distrito Boquete, Fortuna Dam site, *van der Werff & van Hardeveld 6819* (MO); 0.5 km E of Cerro Pate Macho, *Knapp et al. 2109* (MO). PANAMA: Cerro Jefe, *Witherspoon 8539* (MO). VERAGUAS: Cerro Tute, *Moran 4033* (NY).

Elaphoglossum lanceiforme is closely allied to *E. atrobarbatum* of Panama but the latter has longer, black intersporangial scales rather than subulate orange-tan ones and the lamina apex of the latter tends to be broadly acute rather than narrowly so.

Elaphoglossum lankesteri Mickel, sp. nov. TYPE: Costa Rica. Heredia: Volcán Barba, *Lloyd 4201* (holotype, NY).

Ab *E. latifolio* lamina majori distat.

Epiphytic, less commonly terrestrial; rhizome 5–12 mm diam., compact to short-creeping; rhizome scales 4–8 mm long, linear-lanceolate, dull tan to brown, with occasional lateral processes; leaves 55–90 cm long, approximate to ca. 5 mm apart; phyllopodia distinct; petiole usually ¼–⅓ the sterile leaf length; petiole scales present only at the base, to 4 mm long, spreading, lanceolate, with occasional processes; sterile lamina 37–60 cm long, 7–11.5 cm wide, elliptic, chartaceous to subcoriaceous, base cuneate, apex acuminate; veins obscure, ca. 1 mm apart, at ca. 80° angle to costa; hydathodes lacking; lamina surfaces glabrous or with brown stellate trichomidia; fertile leaves slightly shorter to slightly longer than the sterile, somewhat narrower; petiole ca. ½ the fertile leaf length; intersporangial scales lacking.

Distribution. Wet forests; (300–)800–2,600 m.

Paratypes. COSTA RICA. ALAJUELA: ca. 20 km NW of San Ramón, *Smith 2272* (CR, MO, NY, UC). CARTAGO: El Zanjón, *Lankester 645* (US). HEREDIA: Cerro Chompipe, N of San Rafael, *Lems 64082908* (NY). LIMON: Reserva Indígena Talamanca Sukut, *Hammel 17576* (MO). PANAMA. CHIRIQUI: Distrito Boquete, Fortuna Dam site, *van der Werff & van Hardeveld 6617* (MO); 2.2 km SW of Cerro Punta, *Croat 26307* (MO). PANAMA, COMARCA DE SAN BLAS: Nusagandi, *van der Werff 7005* (MO, NY).

This species is distinct from *E. latifolium* by being considerably larger. It is not to be confused with *E. coriifolium* because of *E. lankesteri*'s greater rhizome diameter, cuneate laminar base, more pointed apex, and thinner texture.

The species is named in honor of C. H. Lankester, who collected many fine plant specimens in Costa Rica.

Elaphoglossum latum (Mickel) Atehortúa ex Mickel, comb. et stat. nov. *Elaphoglossum apodum* (Kaulf.) Schott ex J. Smith var. *latum* Mickel, Amer. Fern J. 69: 100 (1979). TYPE: Guatemala: *Steyermark 46369* (holotype, F).
Elaphoglossum lepidothrix Mickel, sp. nov. TYPE: Panama. Coclé: La Mesa above El Valle, *Croat 25402* (holotype, NY).

Ab *E. muscoso* stipitis squamis linearibus ciliato-denticulatis patulis, laminaeque squamis linearibus ciliato-denticulatis sparsis diversa.

Epiphytic; rhizome 4–8 mm diam., compact; rhizome scales 3–6 mm long, linear with hairlike attenuate apex, reddish brown, lustrous, entire; leaves 12–31 cm long, approximate; phyllopodia inconspicuous, covered by scales; petiole ⅓–½ the sterile leaf length, orange-tan; petiole scales 5–8 mm long, spreading, linear, brown to blackish, lustrous, ciliate-denticulate, mixed with 0.5–1 mm understory of orange-tan scales; sterile lamina 8–16 cm long, 3.0–4.3 cm wide, lanceolate-oblong, coriaceous, base broadly cuneate to rounded, apex rounded; veins obscure, ca. 1 mm apart, at 80° angle to costa; hydathodes lacking; lamina scales abaxially 2–3 mm long, linear-lanceolate, orange-tan, ciliate-denticulate, adaxially mostly glabrous, costa occasionally scaly toward base; fertile leaves longer than the sterile; petiole ⅓–½ the fertile leaf length, usually longer than the entire sterile leaf; fertile lamina linear-lanceolate, base rounded, apex obtuse; petiole scales blacker than on sterile leaf, especially distally, costal scales 2 mm long, linear, ciliate-denticulate, intersporangial scales 1 mm long, lanceolate, black-brown, lustrous, ciliate-denticulate, teeth longer than the scale body width.

Distribution. Wet forests; 500–1,300 m.

Paratypes. PANAMA. BOCAS DEL TORO: Oleoducto road, between Ríos Guabo and Guabito, *Churchill 5037* (MO). CHIRIQUI: Fortuna Dam area, *Churchill et al. 4843* (MO). COCLE: Cerro Pilón, *Liesner 782* (MO); 8 km above El Copé, *Hammel 787* (CR). DARIEN: Cerro de Garagará, *Pittier 5649* (US); SW ridge leading to Alturas de Nique, *Hartman 12389* (MO). PANAMA: Valle de Antón, *Ocampo 876* (CR); summit of Cerro Campana, *Porter et al. 4910* (MO); Cerro Jefe, *Witherspoon 8537* (MO).

This species is in the *E. muscosum* complex, but is distinguished by the linear, ciliate-denticulate, spreading petiolar scales.

The specific epithet comes from the Greek, *lepis*, scale, and *trichos*, hair, referring to the very slender scales on petiole and lamina.

Elaphoglossum maculatum Mickel, sp. nov. TYPE: Panama. Coclé: Cerro Pilón, summit, *Dwyer & Lallathin 8959* (holotype, NY).

Ab *E. pygmaeo* frondibus majoribus margine integris, lamina fertili haud decurrenti sporisque cristatis diversa.

Epiphytic; rhizome 1–2 mm diam., horizontal, compact; rhizome scales 1 mm long, linear, hairlike, black, or mixed orange and black scales, strongly indurated, lustrous, grading to dull tan, entire; leaves 4.5–15(–20) cm long, approximate; phyllopodia lacking; petiole ⅛–¼ of sterile leaf length, tan; petiole scales 1.5–2 mm long, scattered, ascending to spreading, linear to subulate, orange-tan, to sclerotic, lustrous, dark brown, entire; sterile lamina 3–12 cm long, 0.6–1.9 cm wide, narrowly elliptic, chartaceous, base attenuate, apex acuminate; veins free, 1.5–2 mm apart, at 60° angle to costa; hydathodes present; lamina scales 1–1.5 mm long, sparse on costa, veins, and margin, spreading, subulate, dull, tan to sclerotic but not dark brown, entire to crenulate; fertile leaves longer than the sterile, the petiole ¾–⅘ of fertile leaf length, as long as the sterile leaf; fertile lamina narrowly elliptic, base cuneate, apex acute to acuminate; scales present on costa and margin but lacking among sporangia.

Distribution. Wet forests; 0–1,400 m.

Paratypes. PANAMA. COCLE: Alto Calvario, 5.5 mi. N of El Copé, *Croat 67549* (MO); vic. of La Mesa, N of El Valle de Antón, *Croat 67282* (UC). DARIEN: SW ridge leading to Alturas de Nique, *Hartman 12380* (MO); Cerro Pirre, *Duke & Elias E-13706* (MO, NY). PANAMA: Rancho Chorro, mts. above Torti Arriba, *Folsom et al. 6695* (CR, MO); Cerro Jefe, *Churchill 3951B* (MO). SAN BLAS: Cerro Brewster, *de Nevers 4033* (MO). VERAGUAS: Cerro Tute, *Moran 4041* (MO); mts. W of Alto de Piedras Siclo Basico school N of Santa Fe, *Hammel 4693* (MO). COLOMBIA. EL VALLE: El Silencio, Yanaconas, *Killip & Garcia 33790* (US); Sabaletas, *Killip & Cuatrecasas 38756* (US). INTENDENCIA DEL CHOCO: La Concepción, 15 km E of Quibdó, *Archer 2083* (US); Río Nuqui, *Haught 5499* (US).

This species is closest to *E. pygmaeum* (Mett. ex Kuhn) Christ of Ecuador, which has smaller (4–8 cm long) leaves with crenulate margins, decurrent fertile lamina, and spores spiculate (vs. crested in Panama). *Elaphoglossum maculatum* is variable in the petiole—mostly short to sessile, some stipitate. *Elaphoglossum pygmaeum* has a rhizome less than 1 mm diameter and orange rhizome scales.

The specific epithet comes from the Latin, *maculosus*, spotted, alluding to the white patches on the leaves.

Elaphoglossum micropogon Mickel, sp. nov. TYPE: Costa Rica. Cartago: Tapantí, ca. 15 km S of Paraíso, *Mickel 2369* (holotype, NY).

Ab *E. paleaceo* stipite brevi et lamina fertili lineari differt.

Epiphytic or epipetric; rhizome 3–4 mm diam., compact; rhizome scales 4–6 mm long, linear-lanceolate, dark reddish brown, lustrous, ciliate-denticulate; leaves 30–39 cm long, approximate; phyllopodia present; petiole ca. $\frac{1}{10}$ of sterile leaf length, tan; petiole scales 3–4 mm, dense, spreading, linear-lanceolate, reddish brown to light orange, lustrous to dull, ciliate-denticulate; sterile lamina 24–30 cm long, 1.4–2.7 cm wide, linear-lanceolate, chartaceous, base attenuate to narrowly rounded, apex acuminate; veins obscure, 1 mm apart, at 70° angle to the costa; hydathodes lacking; lamina scales dense, imbricate, abaxially 2–3 mm long, linear-lanceolate, ciliate-denticulate, pale orange; costal scales 2-4 mm long, dark-tipped; adaxially scales 1–2 mm long, linear with 2–4 strongly ascending teeth, scales erect, reddish brown; fertile leaves slightly longer than the sterile; petiole ⅓–½ of the fertile leaf length; fertile lamina 11–14 mm wide, linear; adaxial scales and costal scales dark, arachnidoid (spiderlike), ca. 1 mm long, intersporangial scales 0.1–0.3 mm long, orange-tan, substellate, among the sporangia and hidden by them.

Distribution. Wet forests; 1,000–1,400 m.

Paratypes. COSTA RICA. ALAJUELA: Reserva Monteverde, Río Penas Blancas, *Bello 134* (CR). CARTAGO: along tributary of Quebrada Casa Blanca Tapantí, *Grayum & Sleeper 3673* (MO); Cañón del Río Grande de Orosí, *Chacón et al. 1520* (CR). PUNTARENAS: Monteverde reserve along Río Penas Blancas to small lagoon, *Hammel et al. 15408* (MO); Navarro, *Wercklé*, in 1905 (P). SAN JOSE: 1–4 km N of La Hondura, *Lloyd 4111* (NY). PANAMA. CHIRIQUI: between Gualaca and Fortuna Dam site on Río Chiriquí, *Croat 49977* (MO); Distr. de Bugaba, along road Volcán–Santa Clara, *van der Werff & Herrera 7070* (MO, NY, UC).

This species is similar to *E. auricomum* (Kunze) T. Moore in the short petiole and linear adaxial laminar scales, but that species has skeletonized scales on both laminar surfaces whereas *E. micropogon* has linear-lanceolate scales on the abaxial surface. It is closely allied to *E. paleaceum*, but differs in the linear fertile lamina, short petiole, and linear adaxial scales.

Lloyd 4245 (Costa Rica, San Vito, Finca Wilson, NY) has a rounded lamina base, sterile lamina 4–4.5 cm wide, and fertile lamina ca. 2 cm wide, and may represent a distinct taxon.

The specific epithet comes from the Greek, *mikros*, small, and *pogon*, beard, referring to the short, scaly petiole.

Elaphoglossum mitorrhizum Mickel, sp. nov. TYPE: Costa Rica. Alajuela: 11 km N of San Ramón, *Mickel 2961* (holotype, NY).

Ab *E. proximo* rhizomatis squamis bicoloribus (parte centrali nigra saepissime sola persistenti) laminisque utrinque nigropunctatis diversa.

Epiphytic; rhizome 1–1.8 mm diam., long-creeping; rhizome scales 0.5–1 mm long, appressed, lanceolate to deltate, black, lustrous, entire; leaves (5–) 8–16 cm long, 1.5–5 cm distant; phyllopodia present; petiole ⅓–½ of sterile leaf length, tan to brown; petiole scales 0.2–1 mm long, lanceolate to round, black to brown, appressed; sterile lamina 3.5–11 cm long, 1.4–4.2 cm wide, ovate-lanceolate, coriaceous, base broadly cuneate, apex acuminate; veins obscure, ca. 1 mm apart, at 75–80° angle to costa; hydathodes lacking; lamina punctate abaxially with round to substellate, black punctae 0.1–0.2 mm long, fewer punctae adaxially; abaxial costa occasionally with sparse, black, reduced, lanceolate, hastate scales; fertile leaves longer than the sterile; petiole ½–¾ of fertile leaf length; fertile lamina narrowly lanceolate, base broadly cuneate, apex acuminate; scales few, small, black on costa, intersporangial scales lacking.

Distribution. Wet forests; 800–1,500 m.

Paratypes. COSTA RICA. ALAJUELA: ca. 1 km SE of La Balsa de San Ramón, ca. 16 km NW of San Ramón, *Smith 2297* (MO, UC), ca. 20 km SW of San Ramón, *Smith 2215* (MO, UC). GUANACASTE: Fila del Volcán Cacao, *Chacón & Chacón 2291* (MO); Parque Rincón de La Vieja, *Herrera 1469* (NY). SAN JOSE: Estación Carrillo, Parque Nacional Braulio Carrillo, *Zamora & Elizondo 677* (CR). PANAMA. CHIRIQUI: Distrito Boquete, Fortuna Dam site, *van der Werff & van Hardeveld 6811* (MO, UC).

The very slender, long-creeping rhizome with sparse, small, black scales and the abaxial lamina with dark punctae or trichomidia distinguish this species. It has been misinterpreted in most herbaria as *E. proximum* Christ (synonym, *E. bradeorum* Christ), but the type specimen of *E. proximum* has scattered, lustrous, golden scales on the abaxial lamina surface.

The specific epithet comes from the Greek, *mitos*, thread, and *rhiza*, root, referring to the very slender rhizome.

Elaphoglossum montgomeryi Mickel, sp. nov. TYPE: Costa Rica. Cartago: ca. 22 km E of Turrialba, above Platanillo, *Mickel 3406* (holotype, NY).

Ab *E. lingua* frondium stipite atque costa squamis nigris obsitis differt.

Epiphytic; rhizome 2 mm diam., creeping; rhizome scales ca. 1.5 mm long, black, sclerotic, lustrous, lanceolate, with weak irregular hair-teeth, especially at scale base; leaves 11–18 cm long, ca. 1 cm apart; phyllopodia present; petiole ca. ⅙ the sterile leaf length, light brown; petiole scales 2.5–4 mm long, black, lanceolate to linear-lanceolate, lustrous to dull, with irregular lateral processes; sterile lamina 8–15 long, (2–)3–4.5 cm wide, oblong, coriaceous, base narrowly cuneate, apex rounded; veins obscure, ca. 1 mm apart, at 80° angle to costa; hydathodes lacking; lamina with abaxial costal scales to 3 mm long, as on petiole but reduced, scattered, still more reduced (ca. 1 mm long) on adaxial costa and abaxial lamina surface; fertile leaves far exceeding the sterile; petiole ca. ½ the fertile leaf length; fertile lamina 17 cm long, 1.1 cm wide, base abruptly narrowed, apex rounded; lamina scales including intersporangial scales lacking.

Distribution. Wet forests; 700–1,500 m.

Paratypes. COSTA RICA. CARTAGO: beside Río Pejibaye, 2 km SW of Taus, *Lent 2962* (F). LIMON: along road 233 between Turrialba and Siquirres, *Crosby 2548* (MICH). PANAMA. PANAMA: summit of Cerro Campana, *Porter et al. 4944* (MO).

This species is close to *E. lingua* in the creeping rhizome, very dark, sclerotic, small, deltate rhizome scales, and rounded lamina apex, but is distinct from that species by the black scales on the stipe and costa. The petiole scales are linear-lanceolate and conspicuous, 3–5 mm long, with slender lateral processes. The costal scales are slender with proportionally longer processes; abaxially on costa they are 1–2 mm long, becoming as small as 0.2 mm on the lamina surface, with fewer adaxially.

The species is named in honor of James D. Montgomery, collector, friend, and student of *Dryopteris*.

Elaphoglossum moranii Mickel, sp. nov. TYPE: Costa Rica. Heredia: end of rte. 113 where road crosses Río Patria, *Moran 3075* (holotype, NY).

Ab *E. lingua* lamina angustiori differt.

Epiphytic; rhizome 2–3 mm diam., creeping; rhizome scales 0.4–1 mm long, deltate, black, sclerotic, lustrous, entire, appressed, scattered; leaves 13–26(–32) cm long, 2–8 mm apart; phyllopodia present; petiole ¼–½ the sterile leaf length, stramineous to brown, glabrous or with dark stellate trichomidia;

sterile lamina 8–18 cm long, 1.2–2.7(–3.4) cm wide, narrowly oblong, coriaceous, base narrowly cuneate, apex rounded; veins obscure, ca. 1 mm apart, at 60–70° angle to costa; hydathodes lacking; fertile leaves far exceeding the sterile; petiole ⅔–¾ the fertile leaf length; fertile lamina 7–12(–30) mm wide, narrower than the sterile; lamina scales lacking.

Distribution. Wet forests; 800–2,500 m.

Paratypes. COSTA RICA. ALAJUELA: along upper Río Sarapiquí, near Cariblanco, *Burger & Antonio 11128* (F); road between San Ramón and Bajo Rodriguez, *Croat 68099* (MO); Upala, Bijagua Camino de El Pilón a Río Celeste, *Herrera 2081* (MO); ca. 20 km N of San Ramón, *Moran 3229* (NY). GUANACASTE: slopes of Miravalles, above Bijagua, *Gómez et al. 19153*. HEREDIA/SAN JOSE: along Río Para Blanca, Cerro de Zurquí, *Burger et al. 9308* (F). HEREDIA: Volcán Barba, *Lloyd 4212* (NY). PANAMA. CHIRIQUI: E of the Fortuna main campsite, *Folsom et al. 5283* (MO); NO de Fortuna, *Correa et al. 2234* (US), *2244* (US). COCLE: 8 km above El Copé, *Hammel 789* (MO).

Elaphoglossum moranii is similar to *E. lingua* in the creeping rhizome and small black sclerotic rhizome scales, but the lamina is more slender (1.2–2.7(–3.4) cm long vs. 2.7–6.5 cm) and the petiole is more slender (ca. 1 mm diam. vs. (1–)1.5–3 mm). It is also similar to *E. longicrure* in lamina shape, but *E. moranii* has a creeping rhizome with small black sclerotic rhizome scales.

The species is named in honor of Robbin C. Moran, fern scholar and coodinator of the Mesoamerican pteridoflora.

Elaphoglossum ornatiforme Mickel, sp. nov. TYPE: Panama. Veraguas: above Río Primero Brazo, 5 mi. NW of Santa Fe, *Liesner 966* (holotype, MO).

Elaphoglosso ornato affinis, sed cum ea squamis costalibus multo minoribus grossius dentatis, laminae stipitisque pilis erectis glandulosis, necnon lamina apice obtusa basi cuneata incongrua.

Epiphytic; rhizome ca. 5 mm diam., compact; rhizome scales 5–9 mm long, linear-lanceolate to lanceolate, red-orange, dull, with weak hair-teeth; sterile leaves 15–18 cm long, approximate; phyllopodia present; petiole ⅛–⅕ the sterile leaf length, orange-brown; petiole scales 2–3 mm long, dense, lanceolate, orange-brown, dull, coarsely toothed, of uneven lengths and with weak hair tips, spreading, the petiole also bearing erect, glandular hairs; sterile lamina 14–15 cm long, 2.8–3.6 cm wide, narrowly oblanceolate, coriaceous, base cuneate, apex obtuse; veins obscure, 1–13 mm apart, at 70° angle to the costa; hydathodes lacking; lamina scales ca. 2 mm long, dense on and limited to costa and margin, lanceolate, orange-tan, dull, coarsely toothed, spreading, lamina surface bearing erect glandular hairs; fertile leaves longer than the sterile; petiole ca. ½ the fertile leaf length; petiole nearly as long as the sterile leaves; lamina linear-oblanceolate, base narrowly cuneate, apex obtuse; scales scattered on costa; intersporangial scales lacking.

Distribution. Wet forests; 700–1,300 m.

Paratypes. PANAMA. DARIEN from Cana up the Cerro Pirre Massif, *Moran 5050* (US); ca. 6 km S from gold mining camp at Cana up the fila leading W to Alturas de Nique, *Lellinger 1965* (US).

This species is closely allied to *E. ornatum* but differs in the following: the costal scales are much smaller (ca. 2 mm long, rather than 5–6 mm) and with coarser teeth; lamina and petiole have erect glandular hairs (lacking in *E. ornatum*); the lamina apex is obtuse, not acute, the base is cuneate, not truncate.

Elaphoglossum pallidiforme Mickel, sp. nov. TYPE: Panama. Panamá: 2.4 mi. beyond Cerro Jefe on road to Altos de Pacora, *Croat 22656* (holotype, NY; isotypes, MO, UC).

Ab *E. pallido* lamina basi rotundata apice caudata necnon rhizomatis squamis brunneis diversa.

Epiphytic; rhizome 5–8 mm diam., compact; rhizome scales 7–10 mm long, 1.2 mm wide, linear-lanceolate, brown, lustrous, entire; leaves 28–50 cm long, approximate; phyllopodia present but short (2–3 mm long), obscured by scales; petiole ⅓–½ of sterile leaf length, orange-brown; petiole totally glabrous; sterile lamina 15–27 cm long, 5.0–6.7 cm wide, lanceolate, chartaceous, base rounded, apex caudate; costa keeled below; lamina glabrous; veins evident, 1.5–2 mm apart, at 70–80° angle to the costa, the vein ends often extended laterally to form a commissural vein; hydathodes lacking; fertile leaves nearly as long as the sterile; petiole nearly ½ the fertile leaf length; fertile lamina linear-lanceolate; intersporangial scales lacking.

Distribution. Wet forests; 600–1,000 m.

Paratypes. COSTA RICA. ALAJUELA: San Carlos, *Jiménez 919* (F). PUNTARENAS: Boruca, *Ocampo 1341* (CR). PANAMA. CHIRIQUI: Palo Alto, 4.5 mi. NE of Boquete, *Hammel 7503* (UC). COCLE: foot of Cerro Pilón, above El Valle de Antón, *Porter et al. 4670* (MO); Cerro Gaital Caracora, *Dwyer 8922* (MO). PANAMA: trail to top of Cerro Pelado, *Antonio 1094* (MO); P. Grande, Santa Fe, *Ocampo 866* (CR). VERAGUAS: shoulder of Cerro Tuti, *Folsom & Edwards 3367* (MO).

Elaphoglossum pallidiforme resembles *E. pallidum* (Baker) C. Chr. in the rounded lamina base and obscured phyllopodia, but it totally lacks lamina

scales and petiole glands and has laterally extended vein tips. It may be more closely related to *E. albomarginatum* A. R. Smith in the lack of glands and scales and the vein tip extensions, but differs from it in the caudate rather than acuminate lamina apex.

Elaphoglossum pardalinum Mickel, sp. nov. TYPE: Panama. Chiriquí: above El Boquete, *Maxon 5718* (holotype, US).

Ab *E. boragineo* lamina angustiori, stipite breviori, squamisque paucioribus, integris, iis laminae et stipitis fuscis diversa.

Epiphytic; rhizome ca. 6 mm diam., horizontal, compact; rhizome scales 3–5 mm long, linear-deltate, dark reddish brown, lustrous, entire, spreading; leaves 21–35 cm long, approximate; phyllopodia lacking; petiole ⅛–⅓ of sterile leaf length, light brown; petiole scales 3–4 mm long, scattered, linear-deltate, dark reddish brown or with paler margin, lustrous, entire, ascending to spreading; sterile lamina 18–31 cm long, 2.4–4.4 cm wide, narrowly elliptic, chartaceous, base narrowly cuneate, apex acuminate; lamina scales 1–3 mm long, sparse, more on costa, few on margin, linear, castaneous to tan, lustrous to dull, entire, appressed; veins obscure, at ca. 70° angle to costa; hydathodes present; fertile leaf not seen.

Distribution. Wet forests; 1,400–1,700 m.

Known only from the type collection.

Elaphoglossum pardalinum resembles *E. oblanceolatum* in the oblanceolate lamina with white patches, but is distinct in the smaller, narrower leaves, slightly longer petiole, and more random white patches (not just between the veins).

The specific epithet comes from the Greek, *pardos*, leopard, alluding to the white spots on the lamina.

Elaphoglossum standleyi Mickel, sp. nov. TYPE: Costa Rica. San José: La Palma, *Standley 33224* (holotype, US).

Elaphoglossum omissum simulans, sed stipitis longioris squamis concoloribus laminaeque fertili conduplicata diversa.

Epiphytic; rhizome 3–4 mm diam., compact; rhizome scales 5–7 mm long, linear-lanceolate, orange-tan, lustrous, entire, spreading; leaves 15–35 cm long, approximate; phyllopodia lacking; petiole ⅖ to nearly half the sterile leaf length, stramineous to tan; petiole scales 2–3 mm long, dense, linear-deltate, orange-tan, dull, denticulate, appressed to ascending; sterile lamina 8–18 cm long, 1.2–2.6 cm wide, lanceolate, chartaceous, base broadly cuneate to rounded, apex acuminate; lamina scales 1–2 mm long, scattered, linear-deltate, tan-orange, lustrous, denticulate, appressed, spreading at margin; veins mostly obscure, 1.5–2 mm apart, at 65° angle to costa; hydathodes present; fertile leaf slightly shorter than the sterile; petiole ⅕ the fertile leaf length; fertile lamina elliptic, base broadly cuneate, apex obtuse to acute, folded lengthwise; intersporangial scales lacking.

Distribution. Wet forests; 1,500–2,400 m.

Paratypes. COSTA RICA. HEREDIA: Cerro de las Caricias, N of San Isidro, *Standley & Valerio 52191* (US), *52198* (US). PUNTARENAS–ALAJUELA BORDER: Monteverde Reserve, Cordillera de Tilarán, *Grayum & Sleeper 3840* (CR, MO). SAN JOSE: N fork of Río Zurquí, Cordillera Central, *Smith 1652* (UC).

This species resembles *E. omissum* Mickel but has concolorous petiole scales, longer petiole, and longitudinally folded fertile lamina.

The species is named in honor of Paul C. Standley, whose extensive collecting has contributed greatly to our knowledge of Central American pteridophytes.

Elaphoglossum teleglottis Mickel, sp. nov. TYPE: Panama. Chiriquí: Distrito Bugaba, Cerro Punta, *van der Werff & Herrera 6503* (holotype, NY; isotypes, MO, UC).

Ab *E. lloensi* laminae squamis lineari-hastatis diversa.

Epiphytic; rhizome 1–1.3 mm diam., long-creeping; rhizome scales 3–4 mm long, ovate-lanceolate, tan, dull or occasionally with lustrous center, entire, ascending; leaves 13–19 cm long, 3–6 cm apart; phyllopodia present; petiole ⅓–½ the sterile leaf length, tan; petiole scales 3–4 mm, scattered, spreading, lanceolate to ovate-lanceolate, tan, dull, entire or with a few processes at base; sterile lamina 8–12 cm long, 2.2–3 cm wide, lanceolate, chartaceous, base narrowly cuneate, apex acuminate; lamina scales orange-brown, abaxially linear-hastate, 4 mm long, with basal processes, to hastate, 1–2 mm long, to linear, 1 mm long, or reduced to punctae; lamina adaxially glabrous; veins evident, 1–1.5 mm apart, at 65–70° angle to costa; hydathodes lacking; fertile leaves longer than the sterile; petiole ⅔ of fertile leaf length; fertile lamina narrowly lanceolate; intersporangial scales lacking.

Distribution. Cloud forests; 2,200 m.

Known only from the type collection.

This species resembles *E. proximum* Christ but has thinner texture, veins more evident, lamina base more narrowly cuneate, rhizome scales entire (rather than fimbriate) and narrower; lamina scales are hastate rather than fimbriate. *Elaphoglossum mitor-*

rhizum differs in having black, appressed rhizome scales 0.5–1 mm long (or larger, tan scales with sclerotic black center) rather than concolorous tan ascending scales 3–4 mm long.

The specific epithet comes from the Greek, *tele*, far, and *glottis*, tongue, referring to the distant leaves on the rhizome.

Elaphoglossum valdespinoi Mickel, sp. nov. TYPE: Panama. Panamá: Cerro Jefe, *Valdespino 891* (holotype, NY).

Stipite abbreviato, laminae squamis angustis nigris, necnon lamina fertili lineari notabilis.

Epiphytic; rhizome 4–6 mm diam., horizontal, compact; rhizome scales 5–7 mm long, linear, reddish brown, lustrous, entire, spreading; leaves 12–22 cm long, approximate; phyllopodia lacking; petiole $\frac{1}{12}$–$\frac{1}{8}$ the sterile leaf length, brown; petiole scales 2–3 mm long, sparse, hairlike-subulate, blackish brown, lustrous, denticulate, spreading; sterile lamina 10–20 cm long, 1.4–2.3 cm wide, narrowly elliptic, chartaceous, base cuneate, apex acute to acuminate; veins obscure, ca. 1.5 mm apart, at 65° angle to costa; hydathodes present; lamina scales scattered, as on petiole, lustrous, 3–6 mm long on costa, 2–4 mm long elsewhere, minutely denticulate, spreading; fertile leaves equal to or slightly longer than the sterile; petiole ½ the fertile leaf length; fertile lamina 5 mm wide, linear, base attenuate, apex obtuse; intersporangial scales 4–6 mm long, dark reddish brown to black.

Distribution. Cloud forests; 100–900 m.

Paratypes. PANAMA. CHIRIQUI: Distrito Boquete, Fortuna Dam site, *van der Werff & van Hardeveld 6808* (UC). PANAMA: Cerro Jefe, *Sytsma et al. 1426* (CR, MO), *2456* (MO), *Porter, et al. 5081* (MO), *Tyson 3404* (MO).

This species is distinguished by its short petiole, long, narrow, black laminar scales, and linear fertile lamina.

The species is named in honor of Iván A. Valdespino, outstanding collector of Panamanian pteridophytes and student of American *Selaginella.*

Acknowledgments. I am grateful to Rupert Barneby for assistance with the Latin diagnoses and to Ruth Russell for her careful reading of the manuscript and many valuable suggestions.

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Two New Combinations in Peruvian *Jaltomata* (Solanaceae)

Thomas Mione
Biological Sciences, Copernicus Hall, Central Connecticut State University, New Britain, Connecticut 06050-4010, U.S.A.

Felix G. Coe
Ecology and Evolutionary Biology, University of Connecticut, Storrs, Connecticut 06269-3043, U.S.A.

ABSTRACT. The new combination *Jaltomata weberbaueri* (Dammer) Mione is based on *Saracha weberbaueri* Dammer; this species resides in Peru, Dept. Ancash, between 3,300 and 3,700 m elevation. The new combination *Jaltomata aspera* (Ruíz & Pavón) Mione is based on *Atropa aspera* Ruíz & Pavón; *Hebecladus asperus* (Ruíz & Pavón) Miers is a synonym. This species resides in Peru, Dept. Lima, from near sea-level to 1,800 m, and is rare, likely due to habitat destruction by humans.

Jaltomata (tribe Solaneae) is a genus of about 28 species of tropical and subtropical perennial herbs and small shrubs that are distributed from Arizona, U.S.A., to southern Bolivia, and with one species each in the Greater Antilles and on the Galápagos Islands.

During study of the genus *Jaltomata* we have found the following new combinations to be necessary. The species treated here are similar but are easily distinguished. *Jaltomata weberbaueri* resides above 3,000 m and is glabrate, while *J. aspera* resides below 1,800 m and is pubescent and ciliate.

Jaltomata weberbaueri (Dammer) Mione, comb. nov. Basionym: *Saracha weberbaueri* Dammer, Bot. Jahrb. Syst. 37: 638. 1906. TYPE: Peru. Ancash: Prov. Cajatambo, Ocros, *A. Weberbauer 2657* (holotype, B destroyed, photo of B sheet F neg. 2558, WIS).

Saracha weberbaueri Dammer subsp. *pallascana* Bitter, Repert. Spec. Nov. Regni Veg. 19: 267. 1924. *Saracha pallascana* (Bitter) Macbride, Publ. Field Columbian Mus., Bot. Ser. 8: 110. 1930. TYPE: Peru. Ancash: Prov. Pallasca, valley of the river Pelagatos, near Yungabal, *A. Weberbauer 7225* (holotype, B destroyed, photo of B sheet F neg. 2559, WIS; isotype, F, photo of F sheet F neg. 49345, WIS).

See Macbride (1962, as *Saracha weberbaueri*) for an English description of this taxon.

Additional specimens examined. PERU. ANCASH: Prov. Recuay, km 107 between Recuay and Pativilca, (fl), *M. Dillon et al. 3174* (BH, GH, MO); Prov. Aija, cuchu cuchu, entre Huamanwilca y Sequipoquian, *C. Ochoa & A. Salas 15160* (NY).

Habitat. Grasslands with scattered bushes, *A. Weberbauer 2657, 7225;* moist ravines, *M. Dillon et al. 3174.*

Altitude. 3,300–3,700 m.

Phenology. Flowering and fruiting January through March.

Local name. "Tomentito," *M. Dillon et al. 3174.*

Jaltomata aspera (Ruíz & Pavón) Mione, comb. nov. Basionym: *Atropa aspera* Ruíz & Pavón, Fl. Peruv., et Chilensis 2: 45. 1799. *Ulticona aspera* (Ruíz & Pavón) Raf., Sylva Telluriana 55. 1838. *Hebecladus asperus* (Ruíz & Pavón) Miers, London J. Bot. 4: 322. 1845. TYPE: Peru. In collibus Limae moninatis Amancaes, *Ruíz López & Pavón s.n.* (holotype, presumably MA not seen).

Saracha ciliata Miers, Ann. Mag. Nat. Hist., ser. 2, 3: 446. 1849, syn. nov. TYPE: Peru. Valley of Lima, *Mathews 834* (holotype, K).

Saracha lacrima-virginis Bitter, Repert. Spec. Nov. Regni Veg. 17: 341. 1921, syn. nov. TYPE: Peru. Amancaes, *A. Weberbauer 1587* (holotype, B destroyed, photo of B specimen F neg. 2551, WIS).

Saracha urbaniana Bitter & Dammer, Repert. Spec. Nov. Regni Veg. 17: 342. 1921, syn. nov. TYPE: Peru. Above San Bartolomé, Lima–Oroya Railroad, *A. Weberbauer 5262* (*5262 = 5305* according to label on photo at WIS) (holotype, B destroyed, photo of B specimen F neg. 2557, GH, WIS; isotype, GH).

See Macbride (1962, as *Hebecladus asperus*, *Saracha ciliata*, and *S. urbaniana*) for English description of this taxon.

Additional specimens examined. PERU. LIMA: Prov. Huarochiri, valley of Río Rimac, near Lima–Oroya highway at km 70 E of Lima, *T. H. Goodspeed & R. D.*

Metcalf 30248 (MO, US); near Lima, *W. Nation s.n.* (K, on same sheet as holotype of *S. ciliata*); hills of Mongomarca, *A. Weberbauer 5235* (US). LIMA: Amancaes, *A. Weberbauer 5246a* (F, US), *A. Weberbauer 5305* (F); San Geronimo, *J. F. Macbride 5912* (F), *D. Stafford* 1932 (K).

Habitat. Loma-formation, *A. Weberbauer 1587, 5235, 5246a*; rocky hillside, *Macbride 5912*; dry open hillside, granite soil, with cacti, *Goodspeed & Metcalf 30248*; sandy hills of Lima, shady places, between stones, rare, *W. Nation s.n.*

All specimens examined were collected prior to 1943; perhaps endangered, due to habitat destruction by humans.

Altitude. Near sea-level to 1,800 m.

Phenology. Flowering and fruiting July through October, and March.

Local name. "Lacrima de la virgen," *A. Weberbauer 1587.*

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Two New Species of *Simsia* (Asteraceae: Heliantheae) from Southern Mexico

Jose L. Panero
Department of Botany, University of Texas, Austin, Texas 78713-7640, U.S.A.

Edward E. Schilling
Department of Botany, University of Tennessee, Knoxville, Tennessee 37996-1100, U.S.A.

ABSTRACT. Two new species from Mexico are described, *Simsia sylvicola* from Oaxaca and *S. spooneri* from Guerrero. The two species are placed in *Simsia* because they exhibit most of the features that characterize the genus, although they differ in possessing a biconvex achene shape that is more typical of the related genus *Viguiera*. Chromosome counts of $n = 17$ are reported for both species.

In the course of our revisionary studies of *Viguiera* Kunth ser. *Grammatoglossae* S. F. Blake, we have discovered two previously undescribed species. There is some question whether these should be placed in *Viguiera* or in the related *Simsia* Persoon, because the distinction between these genera is still problematic. In practice, Spooner (1990) considered *Simsia* to be delimited by features of the disk achenes, which are laterally very flattened and usually have a pappus of two awns but typically lack squamellae. In contrast, the typical disk achene in *Viguiera* is biconvex and has a pappus that includes both two awns and also two or more squamellae. There is, however, a larger suite of traits that, together with the achene features, characterize *Simsia* (Spooner, 1990), including nodal disks, herbaceous involucres, long, narrow ray ovaries, long, tapering style branches, and setose anther connectives. Many of these traits are also exhibited in combination by some of the members of *Viguiera* ser. *Grammatoglossae*. The two new species are particularly striking in differing from typical members of *Simsia* only in features of the achene, and thus further bridge the morphological distinction between the two groups. Further support indicating that *Simsia* and some members of *Viguiera* ser. *Grammatoglossae* are related phylogenetically has been revealed from restriction site analysis of chloroplast DNA (Schilling & Jansen, 1989; Schilling & Panero, unpublished data). Resolution of the exact boundaries between *Simsia* and *Viguiera* ser. *Grammatoglossae* will await further information from DNA-based studies. We argue at this point that the concept of *Simsia* should be broadened relative to that of Spooner (1990) to include some species that have biconvex achenes (there is, in fact, variation within one species of *Simsia*, *S. ghiesbreghtii* (A. Gray) S. F. Blake, for this trait). For this reason, we suggest placement in *Simsia* of the two species newly described here, *S. sylvicola* and *S. spooneri*.

Simsia sylvicola Panero & E. Schilling, sp. nov. TYPE: Mexico. Oaxaca: Km 65 of the road Oaxaca–Sola de Vega, occasional in pine-oak forest, 1,950 m, 10 Nov. 1990, *Panero 2106* (holotype, MEXU; isotypes, ENCB, SI, TENN, TEX, US). Figure 1.

A *Viguiera rhombifolia* (Robinson & Greenman) S. F. Blake foliis perfoliatis et late deltatis et petiolis plerumque non alatis differt.

Perennial herbs 4–10 dm tall, sometimes prostrate. Stems terete, purplish brown, sparsely to moderately puberulent, hispid distally toward the capitulescence. Leaves opposite, triplinerved; petioles 10–23 mm long, terete to slightly canaliculate, sparsely to moderately puberulent to hispid; blades 4–7 cm long, 12–55 mm wide, gradually decreasing in size distally toward the capitulescence, deltate to ovate, base rounded to truncate, apex acuminate, margins serrate to dentate, adaxial surface shiny dark green drying dull brownish green, sparsely to moderately strigose to hirsute, abaxial surface slightly paler in color than adaxial surface, moderately hirsute, pubescence denser on veins outlining them against a green background. Capitulescences dichasial, thyrsoid, open or sometimes heads congested at distal end of peduncles with 3–25+ heads; peduncles 2–30 cm long, pubescence like that of the stem. Heads 6.5–7.5 mm diam. (ligules excluded), 12–13 mm high, campanulate to cylindrical; receptacles 4.5–5.5 mm diam. in fruit, flat to slightly convex. Phyllaries 19–23 in 3 graduated series; phyllaries of first series 3–5.5 mm long, 1.2–1.5 mm wide, ovate to lanceolate, herbaceous, dark

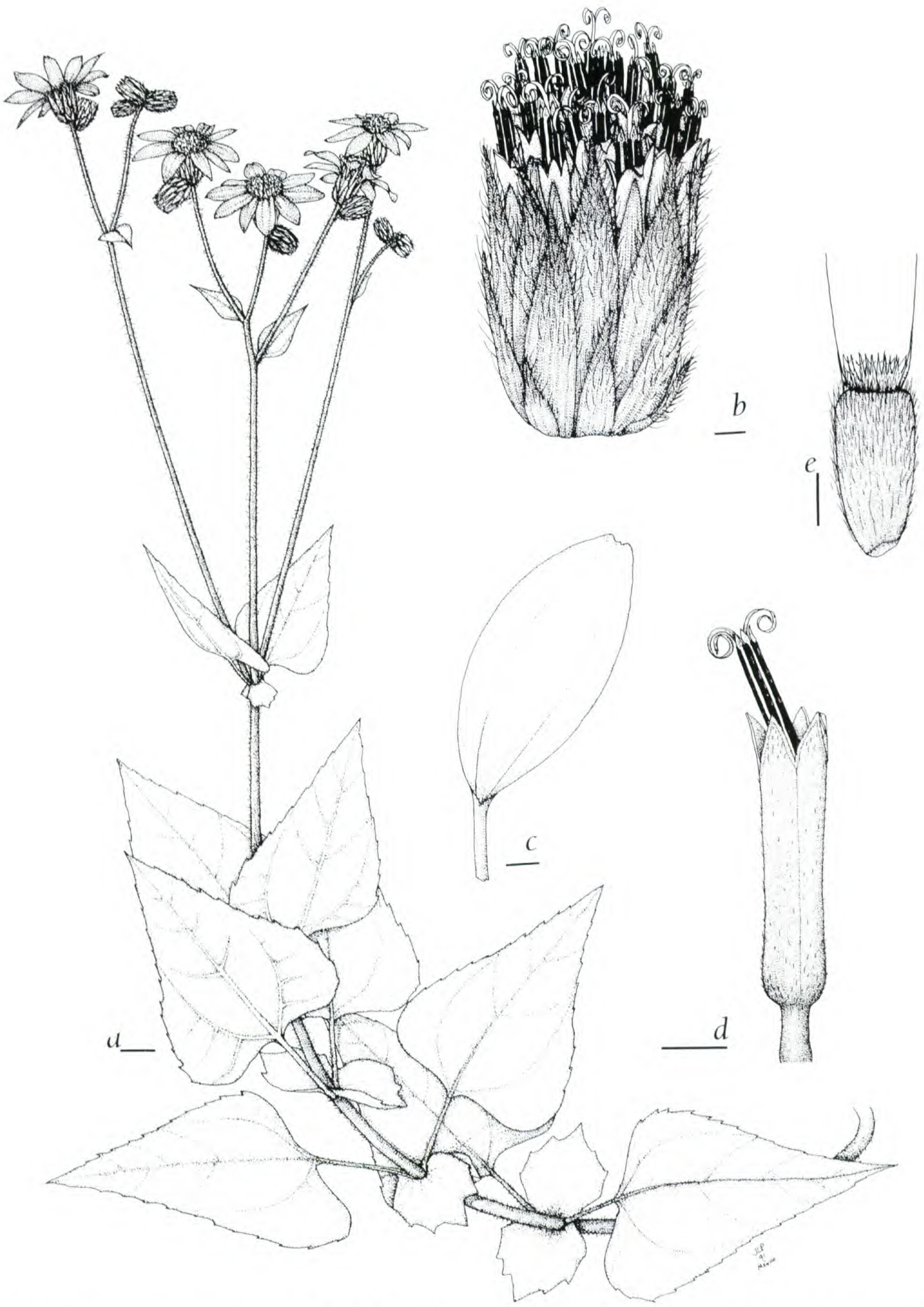

Figure 1. *Simsia sylvicola* Panero & E. Schilling (*Panero 2106*). —a. Habit. —b. Head. —c. Ligule. —d. Disk flower. —e. Achene. Scale bars = 1 cm (a); 1 mm (b–e).

green drying blackish green, sparsely puberulent, hispid distally toward the apex, margins ciliate; phyllaries of second and third series 9–11 mm long, 1.7–2.3 mm wide, lanceolate to narrowly lanceolate, herbaceous, dark green drying blackish green, pubescence as first series. Pales 7–7.8 mm long, 2.8–3.2 mm wide, lanceolate to ovate in outline, conduplicate, shallowly keeled, not exceeding phyllaries,

chartaceous, stramineous turning hyaline whitish with age, essentially glabrous abaxially, apex acuminate to slightly cuspidate, erect, dark green drying black. Ray flowers 7–11(–13); corollas lemon yellow or pale yellow; tube 1.5–1.7 mm long, essentially glabrous; ligule 6.5–9 mm long, 3.5–4.5 mm wide, oval-oblong to suborbicular, sparsely puberulent, apex rounded and minutely bifid; ovaries 5–5.5 mm long, linear, triquetrous, glabrous, pappus of 2–3 minute scales. Disk flowers 25–35, flowers protruding 2–3 mm beyond pales; corollas lemon yellow or greenish yellow turning purplish with age, cylindrical; tube 0.6–0.8 mm long, glabrous or minutely puberulent; throat 4 mm long, 1 mm wide, veins pale orange and discernible the entire length of the throat, glabrous or sparsely puberulent; lobes 0.5 mm long, sparsely puberulent; anthers 2.5 mm long, thecae black; styles 6.5 mm long; style branches 1.8–2.2 mm long. Achenes 3.5–3.7 mm long, 1.5 mm wide, biconvex, oval-obovate, sometimes edged with a minute flat rim, shiny black or mottled, sparsely sericeous, pappus of 2 awns and 0–2 squamellae, awns slender, stramineous, subequal, 1.5–2 mm long, squamellae 0.5 mm long. Chromosome number: $n = 17$.

Paratypes. MEXICO. OAXACA: 15.1 km N of Sola de Vega on road to Oaxaca, 1,800 m, 21 Oct. 1985, *Bartholomew et al. 3251* (CAS, TENN); ca. 10–15 km N Sola de Vega, road to Oaxaca, 1,880 m, 17 Sep. 1988 (in bud), *Schilling & Panero 88-35* (MEXU, TENN; voucher for chromosome count of $n = 17$).

Simsia sylvicola shares a similar habit and floral morphology with *Viguiera rhombifolia*, but the two species can be separated by vegetative characteristics. *Simsia sylvicola* has petiolate leaves with perfoliate bases, whereas *V. rhombifolia* has leaves that appear to be sessile because of the completely winged petioles but are not perfoliate.

The species epithet refers to the characteristic occurrence of the species in open oak-pine woods.

Simsia spooneri Panero & E. Schilling, sp. nov. TYPE: Mexico. Guerrero: 14 km E of Ayotzinapa, ca. km 30 on the road Chilpancingo–Chilapa, 1,900 m, 7 Nov. 1990, *Panero 2032* (holotype, MEXU; isotypes, ENCB, SI, TENN, TEX, US).

A *Viguiera rhombifolia* (Robinson & Greenman) S. F. Blake foliis magnis et late deltatis cum petiolis non alatis, et *Simsia sylvicola* Panero & E. Schilling foliis non perfoliatis differt.

Perennial herbs 4–15 dm tall. Stems terete, purplish brown, sparsely to moderately puberulent to strigose and scabrous, hispid distally toward the capitulescence. Leaves opposite, triplinerved; petioles 7–15 mm long, terete to slightly canaliculate, sparsely puberulent; blades 4–9 cm long, 17–65 mm wide, gradually decreasing in size distally toward the capitulescence, deltate to ovate, base truncate to rounded, apex acuminate to rounded, margins serrate, adaxial surface shiny green drying dull green, sparsely to moderately strigose to hirsute, abaxial surface slightly paler in color than adaxial surface, sparsely hirsute, veins raised and clearly outlined against background, essentially glabrous. Capitulescences dichasial, thyrsoid, open or sometimes heads congested at distal end of peduncles with 3–25+ heads; peduncles 0.5–35 cm long, pubescence like that of the stem. Heads 9–11 mm diam. (ligules excluded), 12–13 mm high, campanulate to cylindrical; receptacles 0.6–0.7 mm diam. in fruit, flat to slightly convex. Phyllaries 16–20 in 2–3 graduated series; phyllaries of first series 2.5–5.5 mm long, 1.5–2.2 mm wide, ovate, herbaceous, dark green drying blackish green, moderately puberulent, margins ciliate; phyllaries of second and third series 8–13 mm long, 2.2–2.7 mm wide, lanceolate to narrowly oblong, herbaceous, dark green drying blackish green, sparsely puberulent especially along mid costae. Pales 9 mm long, 2.5 mm wide, lanceolate to ovate in outline, conduplicate, shallowly keeled, not exceeding phyllaries, chartaceous, stramineous turning hyaline whitish with age, essentially glabrous abaxially, apex acuminate to slightly cuspidate, erect, dark green drying black. Ray flowers 9–13(–15); corollas lemon yellow or pale yellow; tube 1.5 mm long, essentially glabrous; ligule 11–13 mm long, 5–5.5 mm wide, oval oblong to ovate, essentially glabrous, apex acuminate to rounded and minutely bifid; ovaries 5.5 mm long, linear, triquetrous, glabrous, pappus of 2–3 minute scales. Disk flowers 15–30, flowers protruding 2–3 mm beyond pales; corollas lemon yellow or greenish yellow turning deep purple with age, cylindrical; tube 0.6–0.8 mm long, glabrous or minutely puberulent; throat 5.8–6.2 mm long, 1.3–1.6 mm wide, veins pale orange and discernible the entire length of the throat, glabrous or sparsely puberulent; lobes 1 mm long, sparsely puberulent; anthers 3 mm long, thecae black; styles 7–7.5 mm long; style branches 1.8–2.2 mm long. Achenes 3.4–4.2 mm long, 1.4–2 mm wide, biconvex, oblong to obovate, shiny black or mottled, moderately sericeous, pappus of 2 awns and 5–7 squamellae, awns slender, stramineous, subequal, 2.7–3.2 mm long, squamellae 0.5–0.7 mm long. Chromosome number: $n = 17$.

Paratypes. MEXICO. GUERRERO: 9 mi. E of Ayotzinapa, 13 Oct. 1984, *Spooner & Burgos 2610* (OS, TENN);

road to Chichihualco ca. 20 km W from jct. with Hwy. 95, 1,600 m, 19 Sep. 1988 (in bud), *Schilling & Panero 88-43* (TENN; voucher for chromosome count of $n = 17$); Km 20 on the road Chilpancingo–Chichihualco, 1,900 m, 16 Nov. 1990, *Panero 2027* (COL, K, MA, MEXU, TENN, UC, US).

The species epithet honors David M. Spooner, potato specialist at the University of Wisconsin and monographer of *Simsia*, as well as first collector of this taxon.

Simsia spooneri closely resembles *S. sylvicola*, but plants of the two species have a clearly different aspect when grown together in the University of Tennessee greenhouse. *Simsia spooneri* also resembles *S. villasenorii* Spooner in its habit and general morphology. Both species tend to grow on vertical, eroded hillsides where they produce a multitude of flowering shoots of various lengths arising from a central mass of tuberous roots. The two species can be separated by their involucre and disk achene morphologies: *S. spooneri* has a campanulate, green involucre and achenes without flat rims, whereas *S. villasenorii* has an imbricate, purplish urceolate involucre and achenes with a flat rim. *Simsia spooneri* can be confused with *Viguiera rhombifolia*, because they have similar head and achene morphologies, but they differ in leaf and habit characteristics.

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Ardisia callejasii (Myrsinaceae): A New Species from the Antioquian Chocó of Colombia

John J. Pipoly III
Missouri Botanical Garden, P.O. Box 299, St. Louis, Missouri 63166-0299, U.S.A.

ABSTRACT. Continuing studies in Myrsinaceae for *Flora de Colombia* revealed a heretofore undescribed species of *Ardisia* closely related to *Ardisia pittieri* Mez of Costa Rica and Panama.

While determining specimens in Colombian herbaria for my treatment of the Myrsinaceae for *Flora de Colombia*, I discovered a fine series of specimens representing an unknown taxon, described herewith.

Ardisia callejasii Pipoly, sp. nov. TYPE: Colombia. Antioquia: Mpio. Mutatá, N of Hacienda El Darién, right margin of Río Chontadural, 28 July 1978 (fl, fr), *R. Fonnegra & E. Rentería 953* (holotype, HUA; isotypes, COL, MEDEL, MO). Figure 1.

Quoad ramulos furfuraceo-lepidotos, folia magna coriacea oblanceolata brevipetiolata, panicularum ramulos corymbosos, stamina in tubum connata, ad *A. pittieri* valde arcte affinis, sed ab ea laminis ad apicem longi-attenuatis (non acutis), sepalis chartaceis (non coriaceis) 2–2.8 (nec 3–3.5) mm longis, symmetricis (nec asymmetricis) ad apices obtusis (nec emarginatis), petalis ovatis (nec ellipticis), 5.3–5.9 (nec 10–11) mm longis, manifeste (nec obscure) punctatis, staminibus 4.9–5.4 (non 8.7–9.1) mm longis, tubo staminali 1.2–1.3 (nec 1.8–2) mm longo, antheris ad basem inter se liberis (nec conniventibus), denique fructibus luteis (non ruberis) statim separabilis.

Tree to 7 m; branchlets terete, 0.7–1 cm diam., densely and minutely furfuraceous lepidote. Leaves coriaceous, oblanceolate, (25–)31–45.5 cm long, (5–)7–12.2 cm wide, apex long-attenuate, gradually tapering to a cuneate base, costa slightly raised above, prominently raised below, secondary veins 16–20 pairs, slightly depressed or not visible above, prominently raised below, glabrous and dull above, sordid and sparsely and minutely sessile rufous furfuraceous-lepidote below, glabrescent, the margin regular, entire, flat; petioles marginate (0.6–)1–1.2 cm long, glabrous above, densely and minutely rufous furfuraceous-lepidote below. Inflorescence subterminal, pinnately or bipinnately paniculate, (7.5–)12.5–24.5 cm long, pyramidal, primary and secondary bracts unknown, secondary branches 3–12 cm long, the rachis minutely densely furfuraceous-lepidote, glabrescent; floral bracts unknown (presumably early caducous); pedicels cylindrical, 0.7–1.8 cm long, densely furfuraceous-lepidote, persistent. Flowers 5-merous, corymbose, the corymb with 7–12 flowers, pink; sepals quincuncial, almost free, chartaceous, ovate, 2–2.8 mm long, 1–1.3 mm wide, symmetrical, apex obtuse, thickened and prominently black punctate medially, densely and minutely furfuraceous-lepidote, the margin irregular, scarious, hyaline, sparsely glandular-ciliolate, entire; petals quincuncial, basally connivent, coriaceous, ovate, 5.3–5.9 mm long, apex acute, highly reflexed in anthesis, medially thickened, prominently pellucid punctate without, somewhat verruculose medially within, the margin scarious, hyaline, entire, glabrous; stamens 4.9–5.4 mm long, the filaments connate into a coriaceous elobate tube 1.2–1.3 mm long, epunctate, glabrous, the anthers free, lanceolate, 3.5–4.2 mm long, 1.3–1.6 mm wide, sessile on the staminal tube, apex attenuate, base cordate, longitudinally dehiscent by narrow, sublatrorse slits, the connective inconspicuously pellucid punctate; pistil obclaviform, 5.3–5.6 mm long, 1–1.2 mm diam., the ovary 1.5–1.7 mm long, glabrous, the style 3.8–4 mm long, erect, inconspicuously pellucid punctate, glabrous, the placenta ellipsoid, 0.8–1 mm long, 0.3–0.4 mm diam., apex apiculate, the ovules 12–15, pluriseriate, stigma punctiform. Fruit globose, ca. 1 cm diam., green, then yellow at maturity, densely and prominently black punctate, the style base persistent.

Distribution. Ardisia callejasii is endemic to the Municipality of Mutatá, located in the northwestern corner of the Department of Antioquia, Colombia, at 100–180 m elevation.

Ecology and Conservation Status. This new species occurs in lowland pluvial forests, in a narrow valley belonging to the Río Sucio drainage basin, located in the Department of Antioquia between the southwestern corner of the Department of Córdoba and the northwestern corner of the Department of Chocó. Label data from the *Fonnegra et al.* collections indicate it is a common species in forests preserved on Hacienda El Darién. However, because the region is traversed by the Medellín–Turbo high-

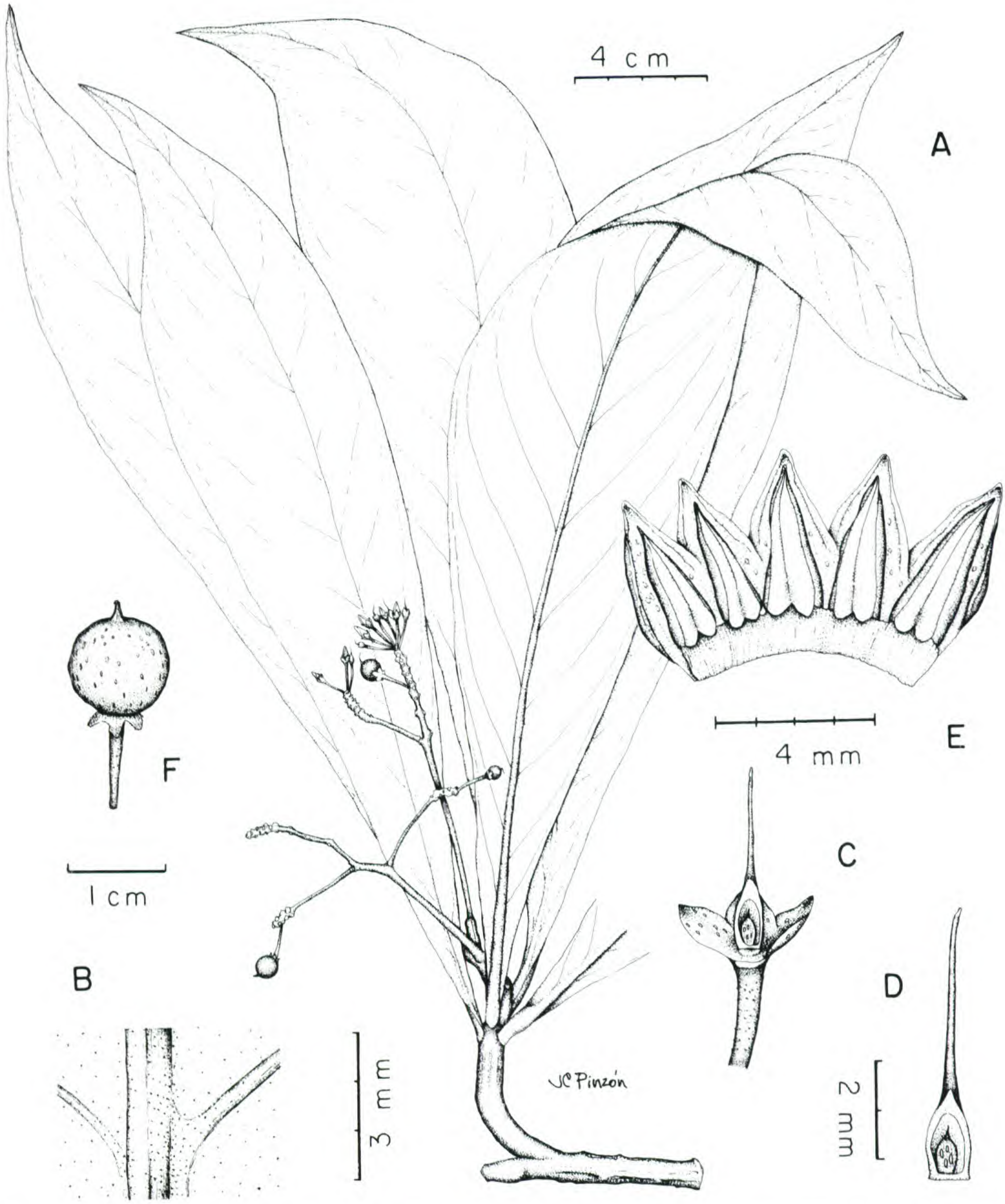

Figure 1. *Ardisia callejasii* Pipoly. —A. Habit, showing pyramidal panicle with corymbose branches. —B. Abaxial leaf surface, showing minutely furfuraceous-lepidote tomentum. —C. Longisection of pistil and calyx, showing ovate sepals, elongate style, and punctiform stigma. —D. Longisection of pistil, showing ellipsoid, apiculate placenta with pluriseriate ovules. —E. Opened corolla, showing staminal tube, sessile, lanceolate anthers and narrow, sublatrorse longitudinal slits. —F. Fruit, showing prominent punctations and persistent style base.

way, *A. callejasii* should be considered a threatened species.

Etymology. It gives me great pleasure to dedicate this new species to Ricardo Callejas Posada, friend, curator of the herbarium of the University of Antioquia (HUA), and pre-eminent authority on the morphogenesis, anatomy, and systematics of the Piperaceae.

Paratypes. COLOMBIA. ANTIOQUIA: Mpio. Mutatá, margin of Río León (Bucabá), Villa Arteaga, Las Caucheras,

hill above water tap, 100–180 m, 2 Oct. 1961 (bud), *Cuatrecasas 26156* (US); Hacienda El Darién, right bank of Río Chontadural, 20 June 1979 (fr), *Fonnegra et al. 1228*, (fl), *1249* (COL, HUA, MO), 13 Sep. 1979 (fr), *Fonnegra 1343* (COL, HUA, MO).

Ardisia callejasii is most closely related to the vicariant *Ardisia pittieri* Mez of Costa Rica and Panama, owing to the furfuraceous-lepidote branchlets, large, coriaceous, oblanceolate leaves, paniclès with corymbose branchlets, and stamens with filaments connate to form a tube. However, the long-attenuate leaf apices, much shorter, obtuse and chartaceous sepals, much shorter, ovate, and prominently punctate petals, shorter stamens and staminal tube, free anthers, and yellow fruit allow for immediate recognition. Within neotropical *Ardisia*, formation of a staminal tube is a synapomorphic character shared by only these two taxa, and the yellow fruit is known only in *A. callejasii*. The vestiture, corolla, and anther morphology indicate placement in the group of *Ardisia* species segregated in the genus *Auriculardisia* Lundell. However, because the majority of the diagnostic characters which define that genus frequently occur in Malesian *Ardisia*, I am not recognizing that entity as distinct.

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Notes on the Genus *Myrsine* (Myrsinaceae) in Peru

John J. Pipoly III
Missouri Botanical Garden, P.O. Box 299, St. Louis, Missouri 63166-0299, U.S.A.

ABSTRACT. Continuing studies in Peruvian *Myrsine* have revealed eight species new to science. These species are described and illustrated, and their systematic relationships are discussed. Treatment of *Rapanea* as a taxonomic synonym of *Myrsine* necessitates six new combinations for Peruvian species and another four combinations for related taxa from Colombia, Ecuador, Bolivia, and Brazil.

In preparation for publication of the Myrsinaceae for the *Catalogue of the Flowering Plants and Gymnosperms of Peru*, it has become necessary to publish a number of novelties and new combinations. The genus *Myrsine* L., as here recognized, includes all neotropical members of the genus *Rapanea* Aublet, formerly recognized as separate from it based on the sessile anthers and lobed stigmas. A preliminary discussion of reasons for reducing *Rapanea* to synonymy under *Myrsine* has been presented elsewhere (Pipoly, 1992). *Myrsine* is a pantropical genus of perhaps upwards of 150 species, of which 80, many as yet undescribed, are neotropical.

Myrsine microdonta Pipoly, sp. nov. TYPE: Peru. La Libertad: Prov. Santiago de Chuco, Huacás, Cachicadán, 2,800 m, 15 June 1984 (pist. fl, fr), *A. Sagástegui, J. Mostacero & M. Diestra 11903* (holotype, MO; isotypes, BISH, CAS, F, HUT, US). Figure 1.

Quoad ramulos graciles ad apices dense ferrugineo-tomentosos, folia alterna, plana, superne nitida, inferne tristia, ad bases rotundata, necnon lobos calycinos coriaceos ovatos, *M. brevis* valde affinis sed ab ea ramulis adpresse (non floccose) tomentosis lamina secus margines apicem versus manifeste dentata (non integerrima), mucronulata (nec emarginata), minute ciliolata (nec glabra), lobis calycinis ad apices minutissime ciliolati (non glabris), lobis corollinis ellipticis (non ovatis) secus margines involutis (nec planis) praeclare distat.

Shrub, height unknown; branchlets prominently ridged, 2–3 mm diam., adpressed ferrugineous tomentose apically, glabrescent. Leaves coriaceous, elliptic, 1–2 cm long, 0.7–1.3 cm wide, apex broadly rounded, mucronulate, base rounded, decurrent on the petiole, smooth and nitid above, dull and prominently black perpuncticulose below, costa deeply impressed above, prominently raised below, the secondary veins not visible above or below, the margin very minutely ciliate in bud, the cilia glabrescent, prominently dentate from the middle to the apex, subrevolute basally, glabrous; petioles deeply canaliculate, 4–6 mm long, densely tomentose above, glabrous below. *Staminate inflorescence:* unknown. *Pistillate inflorescence:* a subsessile umbel, 3–5-flowered; floral bracts lanceolate, 1–1.2 mm long, 0.3–0.4 mm wide, apex acute, the margin entire, minutely glandular-ciliate; pedicels ridged, 1.4–1.6 mm long, glabrous. Flowers 5-merous, green; calyx coriaceous, cotyliform, 1.3–1.4 mm long, the tube 0.5–0.6 mm long, the lobe ovate, 0.8–0.9 mm long, 0.6–0.7 mm wide, apex acute, sparsely but prominently black punctate without, very minutely ciliolate apically, the margin entire; corolla coriaceous, rotate, 3–3.6 mm long, the tube 0.9–1.2 mm long, the lobes elliptic, 2.1–2.4 mm long, 1.1–1.2 mm wide, reflexed at anthesis, apex rounded, very minutely puberulent near the margin within and without, sparsely but prominently short black punctate-lineate without, the margin entire, involute; sterile anthers inserted 0.8–1.1 mm above the base of the corolla tube, the filaments 0–0.3 mm long, flat, epunctate, the anthers elliptic, 1–1.7 mm long, apex rounded, base cordate, the connective epunctate; pistil terete, 2.4–2.5 mm long, the ovary globose, 1–1.2 mm long and in diam., prominently short black punctate-lineate, the stigma sessile, sinuate-capitate, prominently vertically lobed, 1–1.1 mm long, 0.9–1 mm wide, persistent in fruit, placenta globose, 2-ovulate. Fruit subglobose, 4.5–5.5 mm long, 4–5 mm diam. sparsely but prominently short black punctate-lineate.

Distribution. Known only from the type, collected on rocky hillsides, at 2,800 m.

Myrsine microdonta is most closely related to *M. brevis* (J. F. Macbride) Pipoly, but is easily recognized by the appressed tomentum of the branchlets, leaves with dentate and ciliolate margins, mucronulate apices, apically minutely ciliolate calyx lobes, and elliptic corolla lobes with revolute margins. The specific epithet refers to the dentate leaf margins, a character unknown in any other tropical American species.

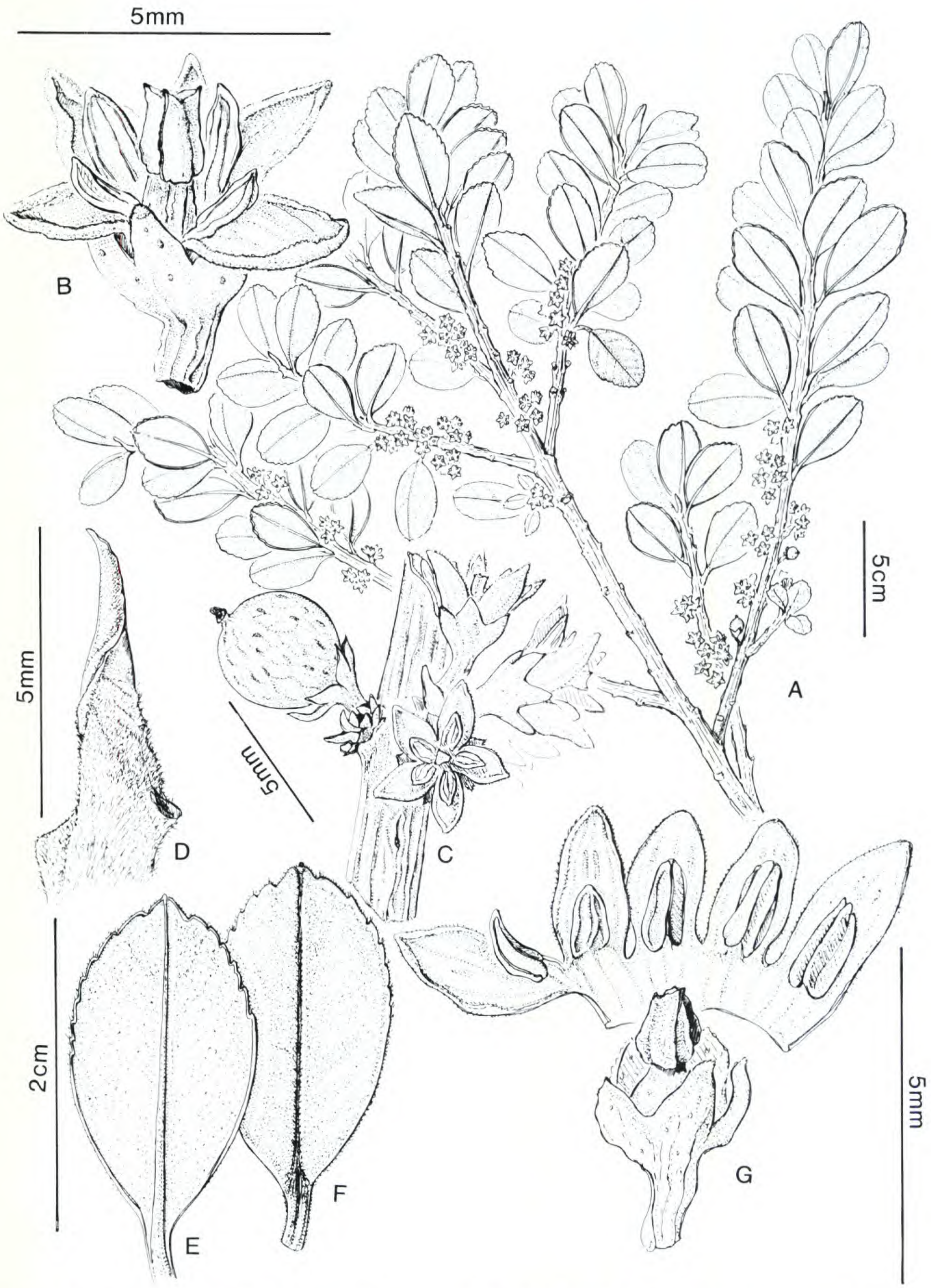

Figure 1. *Myrsine microdonta* Pipoly. —A. Habit. —B. Pistillate flower habit, showing rotate corolla with involute lobes. —C. Pistillate inflorescences, showing flower viewed from above and fruit. —D. Branchlet apex, showing glandular-ciliate leaf bud margin. —E. Abaxial leaf surface, showing dentate, ciliolate margin, mucronulate apex, and prominently raised costa. —F. Adaxial leaf surface, showing densely pilose, impressed costa and canaliculate petiole. —G. Open pistillate flower, showing elliptic corolla lobes and sinuate-capitate stigma. A–G, drawn from holotype.

Myrsine fosteri Pipoly, sp. nov. TYPE: Peru. Pasco: Prov. Oxapampa, Oxapampa–Pasco boundary, Abra San Guttardo, divide between Chontabamba and Río Paucartambo Valley, 2,500–3,000 m, 29 Dec. 1983 (stam. fl), *Foster, Chanco & Albán 7636* (holotype, MO; isotypes, AMAZ, F, NY, USM). Figure 2.

Ob ramulos dense ferrugineo-piloso-tomentosos, folia ad apices obtusa vel emarginata atque minutissime mucronulata, lobos corollinos manifeste atropunctatos atque punctatolineatos, lobos calycinos manifeste atropunctatos *M. dependenti* valde affinis sed ab ea foliis alternis (non distichis) ad bases obtusis vel subcordatis (non sueto rotundatis), lobis calycinis sparse glandulari-pilosis (non glabris) secus margines dense longe-glandulari-pilosis (nec parce glandulari-ciliolatis) manifeste atro-punctatis (nec punctato-lineatis), lobis corollinis ad apices acutis (non rotundatis) secus margines involutis (nec planis), antheris oblongis (non ovatis) ad apices apiculatis (nec rotundatis) facile cogniscitur.

Shrub to 2(–3) m tall; branchlets terete, 2–3 mm diam., densely ferrugineous pilose. Leaves coriaceous, ovate to obovate (1.3–)2–3 cm long, 1.4–2 cm wide, apex obtuse to emarginate, mucronulate, base obtuse to subcordate, decurrent on the petiole, sparsely pilose above, densely pilose below, the costa impressed and densely pilose above, prominently raised and densely pilose below, the secondary veins 6–8, visible but not raised above and below, inconspicuously pellucid punctate, the margin densely pilose in bud, persistent, not ciliate, revolute, epunctate, glabrous; petioles canaliculate, 3–5 mm long, densely pilose above and below. *Staminate inflorescence:* a subsessile umbel, (1–)3-flowered; floral bracts ovate, ca. 0.5 mm long, densely pilose, the apex rounded, the margin revolute, glandular-pilose; pedicels terete, 0.7–0.9 mm long, glabrous. Flowers 5-merous, pinkish green; calyx chartaceous, cotyliform, ca. 1 mm long, the tube ca. 0.1 mm long, the lobes ovate, 0.8–0.9 mm long, 0.4–0.5 mm wide, apex obtuse, prominently black punctate, sparsely glandular-pilose without, glabrous within, the margin entire, densely glandular-pilose; corolla chartaceous, campanulate, 2.1–2.9 mm long, the tube 0.4–0.5 mm long, the lobes elliptic, 1.7–2.4 mm long, 1–1.1 mm wide, apex acute, glabrous except minutely pilose apically, prominently short black punctate-lineate without, the margins entire, involute, glabrous; stamens inserted at junction of the corolla tube and lobes, the anthers sessile, oblong, 1.6–1.8 mm long, 0.6–0.8 mm wide, apex apiculate, base cordate, the connectives epunctate; pistillode cylindrical, 1.2–1.3 mm long, 0.5–0.6 mm diam., the pistil ellipsoid, 0.6–0.7 mm long, the stigma irregularly lobed, 0.3–0.4 mm long. *Pistillate inflorescence:* a subsessile umbel, 1–2-flowered; floral bracts ovate, ca. 0.3 mm long, densely pilose, the apex rounded, the margin revolute, glandular-pilose; pedicels terete, 0.5–0.7 mm long, glabrous. Flowers 5-merous, pinkish green; calyx chartaceous, cotyliform, ca. 1 mm long, the tube ca. 0.1 mm long, the lobes ovate, 0.8–0.9 mm long, 0.4–0.5 mm wide, apex obtuse, prominently black punctate, sparsely glandular-pilose without, glabrous within, the margin entire, densely glandular-pilose; corolla, staminodes and pistil unknown. Fruit globose, 3–3.5 mm long and in diam., with a few scattered, prominent short, black punctate-lineations.

Distribution. Endemic to the short shrubby "pajonal" formations above cloud forest areas in Huánuco and Pasco, Peru, at 2,500–3,600 m elevation.

Paratypes. PERU. HUANUCO: Prov. Huánuco, Carpish Pass, above Chinchao, 9°42′S, 76°04′W, 24 Oct. 1947 (fr), *Fosberg 28856* (MO, NA, US, USM). PASCO: Prov. Oxapampa, Cordillera Yanachaga, Cerro Pajonal, 12 km SE of Oxapampa, 20°35′S, 75°20′W, 2,700–2,800 m, 7 Oct. 1982 (bud), *Foster 9011* (AMAZ, F, MO, USM); San Gotardo, 36 km W of Oxapampa, 10°39′S, 75°37′W, 2,850 m, 21 Nov. 1982 (stam. fl), *D. Smith 2762* (MO, NY, USM); Oxapampa–Cerro de Pasco Rd., 38 km W of Oxapampa, 10°39′S, 75°37′W, 2,750 m, 19 May 1983 (fr), *D. Smith 4121* (MO, USM).

Myrsine fosteri may be confused with *M. dependens* (Ruíz & Pavón) A. Sprengel, but is easily separated by its alternate leaves with obtuse or subcordate bases, sparsely glandular-pilose and prominently black punctate calyx lobes with densely long glandular-pilose margins, acute, involute corolla lobes, and oblong anthers with apiculate apices. This species is dedicated to Robin Foster, ecologist and floristic systematist, and one of the experts in the study of Peruvian flora.

Myrsine dilloniana Pipoly, sp. nov. TYPE: Peru. Amazonas: Prov. Bagua, Cordillera Colán, E of La Peca, 3,200 m, 28 Aug. 1978 (pist. fl, fr), *Barbour 3257* (holotype, MO; isotypes, AMAZ, F, LL-TEX, USM). Figure 3.

Quoad ramulos angulatos, folia alterna, cartilaginea, elliptica, ad apices obtusa vel rotundata, bases late rotundata, petiolos usque ad 6 mm longos marginatosque, pedicellos acute angulatos, lobos calycinos ovatos, species haec *M. lehmanii* arcte similans, sed ab ea laminis 4–6 (non 2–3.5) cm longis atque, 2.5–3.2 (nec 1–1.5) cm latis, lobis calycinis carinatis (non planis) secus margines crenulatis (nec integerrimis), lobis corollinis lineari-lanceolatis (non oblongis) inconspicue pellucido-punctatis (nec epunctatis) secus margines minutissime ciliolatis (nec glabris) praeclare diagnoscenda.

Shrub to 2.5 m; branchlets angulate, 2.5–3.5 mm diam., glabrous. Leaves cartilaginous, elliptic, 4–6 cm long, 2.5–3.2 cm wide, apex obtuse, base

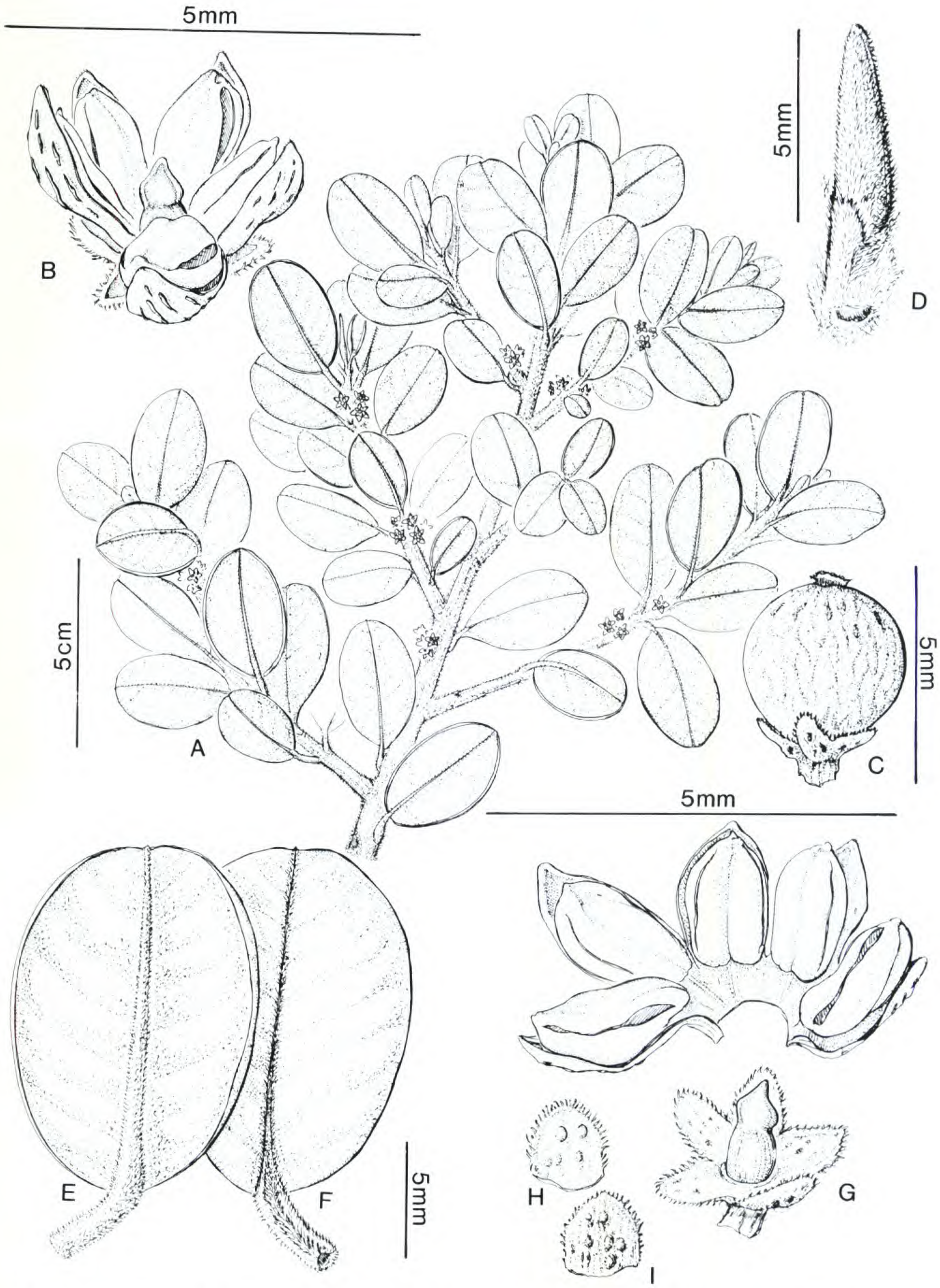

Figure 2. *Myrsine fosteri* Pipoly. —A. Habit. —B. Staminate flower habit, showing prominently punctate-lineate corolla lobes. —C. Calyx and fruit, showing prominent punctations on calyx lobes and few, scattered punctate lineations on fruit. —D. Branchlet apex, showing pilose indumentum. —E. Abaxial leaf surface, showing densely pilose, prominently raised costa, mucronulate apex, and revolute margin. —F. Adaxial leaf surface, showing deeply impressed, densely pilose costa. —G. Opened pistillate flower and calyx with pistillode, showing densely glandular-pilose calyx lobe margins and ellipsoid pistillode. —H. Adaxial calyx lobe surface, showing prominently raised punctations. —I. Abaxial calyx lobe surface. A, B, D–I, drawn from holotype; C, drawn from *Fosberg 28856*.

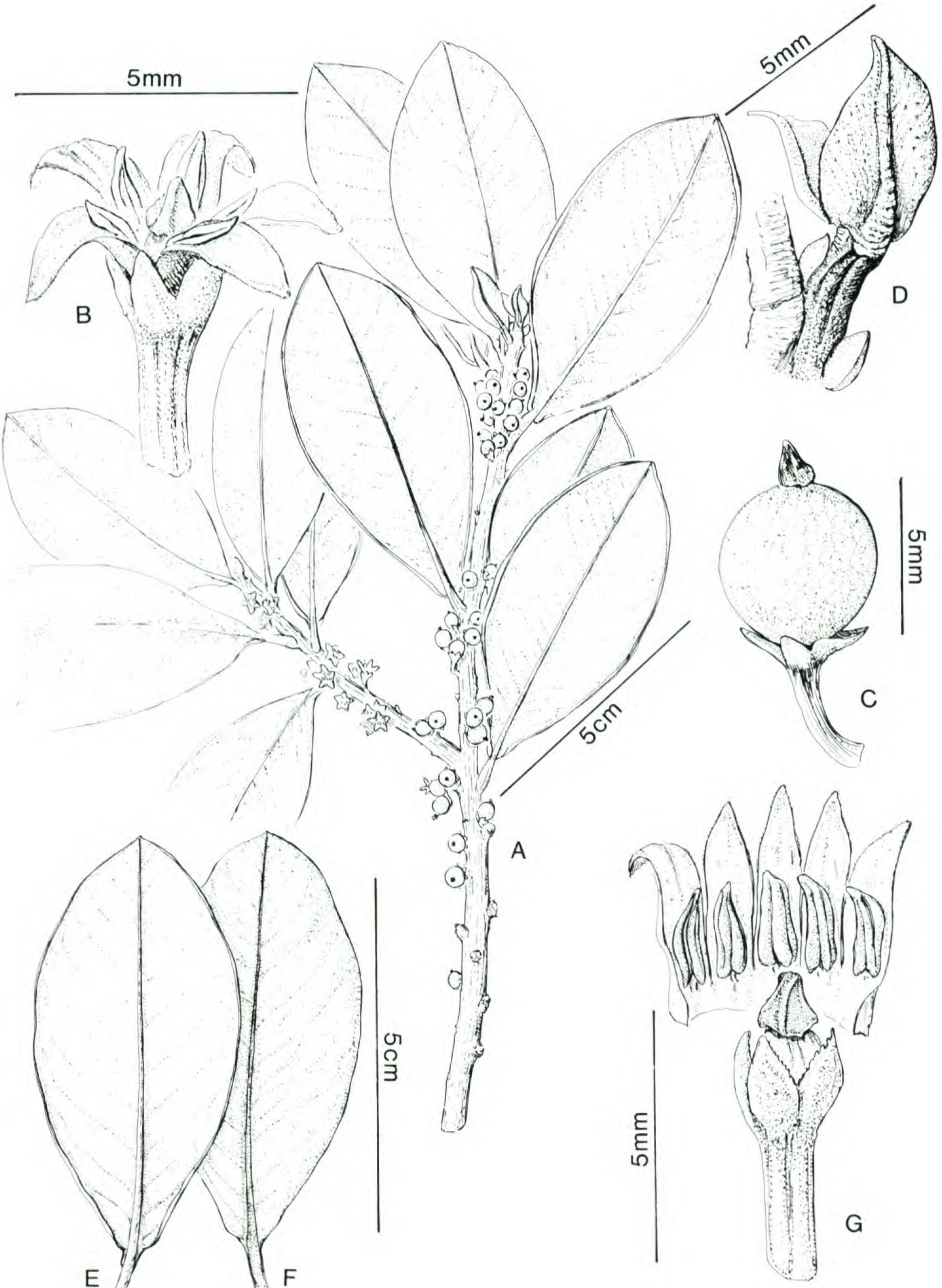

Figure 3. *Myrsine dilloniana* Pipoly. —A. Habit. —B. Pistillate flower habit. —C. Fruit, showing persistent prismatic stigma and globose fruit. —D. Branchlet apex, showing leaf bud with revolute, glabrous margin. —E. Abaxial leaf surface, showing revolute leaf base and prominently raised costa. —F. Adaxial leaf surface, showing slightly impressed costa and canaliculate petioles. —G. Opened pistillate flower, showing linear-lanceolate corolla lobes, apiculate anthers, crenulate calyx lobes and prismatic stigma. A–G, drawn from holotype.

rounded, decurrent on the petiole, dull above and below, the costa deeply impressed above, prominently raised below, the secondary veins scarcely visible from above, 12–15 pairs, densely and very minutely scrobiculate above, smooth below, the punctations small, pellucid, inconspicuous, the margin revolute, entire, glabrous in bud and at maturity; petioles marginate, 3–7 mm long, glabrous. *Staminate inflorescence:* unknown. *Pistillate inflorescence:* a subsessile 15–20-flowered umbel; floral bracts ovate, 1.3–1.5 mm long, 0.6–0.7 mm wide, apex acute, early caducous, glabrous, the margins entire, glabrous; pedicels angulate, 2.6–2.8 mm long, glabrous. Flowers 5-merous; calyx coriaceous, cotyliform, 2–2.1 mm long, the tube ca. 0.1 mm long, the lobes ovate, 1.8–2 mm long, 1–1.1 mm wide, apex acute, medially thickened, carinate, inconspicuously pellucid punctate, the margin minutely crenulate; corolla coriaceous, rotate, 3.9–4.1 mm long, the tube 0.5–0.7 mm long, the lobes linear-lanceolate, 3.2–3.4 mm long, 0.7–0.8 mm wide, apex subulate, inconspicuously pellucid punctate, the margins very minutely ciliolate; pistil 2.6–2.8 mm long, the ovary ellipsoid, 1.7 mm long, 1.2 mm diam., the ovary costulate, the stigma sessile, prismatic, 3-angled, ca. 1 mm long, 0.7 mm diam., the placenta subglobose, 2-ovulate. Fruit globose, 3.5–5 mm long and in diam., smooth, inconspicuously punctate.

Distribution. Known only from the type, in elfin forest, at 3,200 m.

Myrsine dilloniana is closely related to *M. lehmannii* (Standley) Pipoly, but may be recognized by its longer and wider leaves, carinate calyx lobes with crenulate margins, and linear-lanceolate, inconspicuously punctate corolla lobes with very minutely ciliolate margins. I dedicate this species to Michael Dillon (F), co-principal investigator for the American side of the Flora of Peru Project.

Myrsine diazii Pipoly, sp. nov. TYPE: Peru. Amazonas: Prov. Luya, Camporedondo–Tullanya, path to Cerro Huicsocunga, 2,350 m, (stam. fl), *Díaz & Campos 3681* (holotype, MO; isotypes, AMAZ, BISH, F, US, USM). Figure 4.

Species haec ob ramulos glabros, folia membranacea, anguste oblanceolata vel elliptica, punctata atque punctato-lineata, ad apices basesque acuta, petiolos marginatos, lobos calycinos ovato-triangulares ciliolatos necnon minute atro-punctatos, stigmata carnosa *M. pellucido-punctatae* valde arcte affinis, sed ab ea ramulis angulatis (non teretibus) 2.5–3.5 (nec 6–8) mm diametro, inflorescentiis subessilibus (non ramulis brevibus insidentibus), umbellatis (nec fasciculatis), pedicellis angulatis (non teretibus), tubo corollino quadrato (non cylindrico), lobis corollinis manifeste atropunctatis atque punctato-lineatis (non epunctatis), antheris apiculatis (non acutis) facile separabilis.

Tree 6–8 m tall; branchlets angulate, 2.5–3.5 mm diam., glabrous. Leaves membranaceous, elliptic to narrowly oblanceolate, (3.6–)5–6.2 cm long, 1.6–2 cm wide, apex and base acute, decurrent on the petiole, the costa slightly impressed above, prominently raised below, the secondary nerves not prominent, 13–18 pairs, nitid above, dull below, densely pellucid punctate, the margin entire, flat or subrevolute, opaque, minutely glandular-ciliolate in bud, glabrous at maturity; petioles marginate, 3–6 mm long, glabrous. *Staminate inflorescence:* a subsessile umbel, 4–6-flowered; floral bracts very widely ovate, ca. 1 mm long, 1.4 mm wide, the apex obtuse, the margin glandular-ciliolate; pedicels angulate, 0.7–1 mm long, glabrous. Flowers 5-merous; calyx chartaceous, cotyliform, 0.8–1 mm long, the tube ca. 0.1 mm long, the lobes widely ovate, 0.7–0.9 mm long, 0.7–0.8 mm wide, apex acute, sparsely black punctate, the margin entire, glandular-ciliolate; corolla cotyliform, 2.7–2.8 mm long, the tube square, 0.2–0.3 mm long, the lobes lanceolate, 2.4–2.6 mm long, 0.9–1 mm wide, apex acute, densely and prominently black punctate and punctate-lineate without, glabrous within, the margin entire, minutely glandular-ciliolate; stamens inserted at junction of corolla tube and lobe, the anthers sessile, oblong, 2–2.1 mm long, 0.9–1 mm wide, apex apiculate, the apiculum proximally curved, base deeply cordate, the connective epunctate; pistillode obturbinate, 1.5–1.6 mm long, 0.5–0.6 mm diam., the ovary hollow, the stigma sessile, carnose. *Pistillate inflorescence:* a subsessile umbel, 4–6-flowered; floral bracts very widely ovate, ca. 1 mm long, 1.4 mm wide, the apex obtuse, the margin glandular-ciliolate; pedicels angulate, 0.5–1 mm long, glabrous. Flowers 5-merous; calyx chartaceous, cotyliform, 0.8–1 mm long, the tube ca. 0.1 mm long, the lobes widely ovate, 0.7–0.9 mm long, 0.7–0.8 mm wide, apex acute, sparsely black punctate, the margin entire, glandular-ciliolate; corolla cotyliform, 2.3–2.5 mm long, the tube square, 0.6–0.8 mm long, the lobes lanceolate, 1.7–1.9 mm long, 0.5–0.6 mm wide, apex acute, densely and prominently black punctate and punctate-lineate without, glabrous within, the margin entire, minutely glandular-ciliolate; staminodes inserted at junction of corolla tube and lobe, the sterile anthers sessile, oblong, 1.3–1.5 mm long, 0.9–1 mm wide, apex apiculate, the apiculum proximally curved, base deeply cordate, the connective epunctate; pistil obturbinate, 1.8–2 mm long, 0.9–1 mm diam., the ovary subglo-

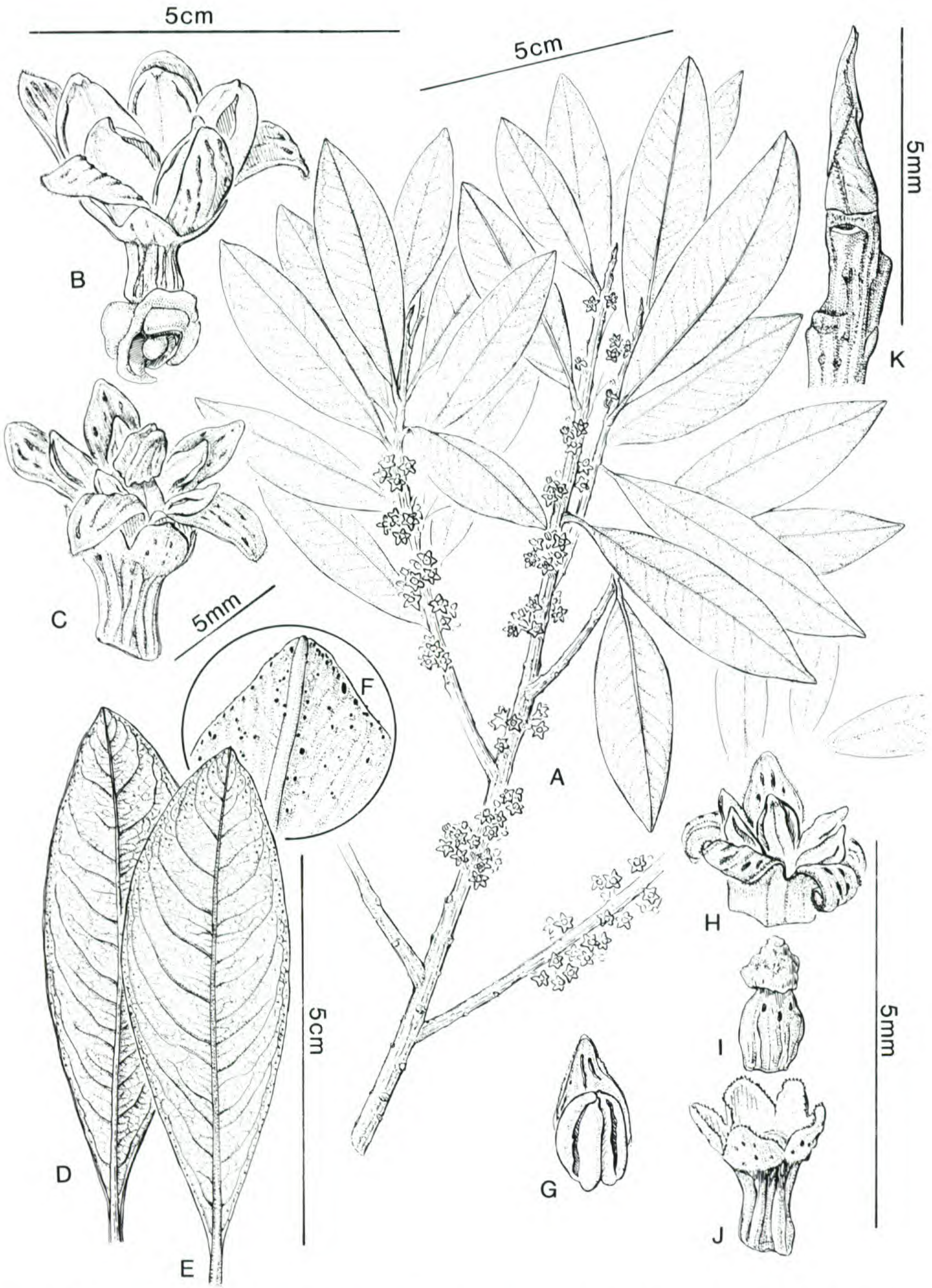

Figure 4. *Myrsine diazii* Pipoly. —A. Habit. —B. Staminate flower habit, showing corolla lobes with prominent pellucid punctations and punctate lineations, apiculate anthers. —C. Pistillate flower habit, showing same features as in staminate flower and conical, carnose stigma. —D. Abaxial leaf surface, showing basally revolute margin, leaf reticulation, and prominently raised costa. —E. Adaxial leaf surface, showing slightly impressed costa and decurrent base on marginate petiole. —F. Leaf apex detail, showing dense pellucid punctations. —G. Sterile anther and corolla lobe in proximal view. —H. Pistillate corolla, showing square corolla tube and reflexed corolla lobes. —I. Pistil, showing conical, carnose stigma. —J. Pistillate calyx, showing cotyliform habit, sparse black punctations, and glandular-ciliolate margins. —K. Branchlet apex, showing glandular-ciliate leaf bud margin. A, B, D–F, K, drawn from holotype; C, G–J, drawn from *Díaz & Campos 3726*.

bose, 0.9–1 mm long, prominently black punctate-lineate, the placenta subglobose, 2–4-ovulate, the stigma conical, carnose, 0.9–1 mm long. Fruit unknown.

Distribution. Known only from the type and paratype, presumably endemic to the cloud forests of Cerro Huicsocunga, 2,350 m elevation.

Paratype. PERU. AMAZONAS: Prov. Luya, Camporedondo–Tullanya, path to Cerro Huicsocunga, 2,350 m, 3 Sep. 1989 (pist. fl), *Díaz & Campos 3726* (AMAZ, F, US, USM).

Myrsine diazii is most closely related to *M. pellucido-punctata* Oersted of Costa Rica and Panama, but is easily distinguished from it by the thinner, angulate branchlets, subsessile, umbellate inflorescences, angulate pedicels, square corolla tube, prominently black punctate and punctate-lineate corolla lobes, and apiculate anthers. It is dedicated to Camilo Díaz Santibañez, Peruvian national coordinator of the field research associates for the Flora of Peru project and specialist in Peruvian Araliaceae.

Myrsine reynelii Pipoly, sp. nov. TYPE: Peru. Piura: Prov. Huancabamba, Dtto. Canchaque, between Chorro Blanco and War War, 2,000–2,500 m, 18 Jan. 1989 (fr), *Díaz, Pennington & Reynel 3180* (holotype, MO; isotypes, AMAZ, USM). Figure 5.

Propter laminam coriaceam ellipticam vel oblanceolatam insuper scrobiculatam, petiolos marginatos, lobos calycinis coriaceos inconspicue pellucido-punctatos, *M. sodiroanae* affinis sed ab ea laminis atropunctato-lineatis (non inconspicue punctatis) secus margines revolutis (nec planis), pedicellis cylindricis (non angulatis) 2–3.3 (nec 6–8) mm longis, lobis calycinis ovatis (non late triangularibus) secus margines glabris (nec ciliolatis) praeclare distat.

Tree to 8 m tall; branchlets terete, 4–6 mm diam., glabrous. Leaves coriaceous, elliptic to oblanceolate, 6–10 cm long, 2–3 cm wide, apex acute, base cuneate, decurrent on the petiole, the costa impressed above, prominently raised below, secondary veins not prominent, 15–19 pairs, nitid, scrobiculate and somewhat rugose above, pallid and conspicuously black punctate and punctate-lineate below, the margin entire, opaque, revolute, prominently black punctate, minutely glandular-ciliate in bud, glabrous at maturity; petioles marginate, 0.8–1(–1.4) cm long, glabrous. *Staminate inflorescence:* not seen. *Pistillate inflorescence:* a sessile fasicle, 5–9-flowered; floral bracts coriaceous, very widely ovate, ca. 0.9–1.2 mm long, 0.9–1.3 mm wide, the apex acuminate, the margin opaque, entire, glabrous; pedicels cylindrical, 2–3.3 mm long, glabrous. Fruiting calyx 5-merous, coriaceous, cotyliform, 1–1.4 mm long, the tube ca. 0.2–0.3 mm long, the lobes ovate, 0.7–1.1 mm long, 0.5–0.7 mm wide, apex subacuminate, inconspicuously pellucid punctate, the margin entire, glabrous; corolla, androecium, and gynoecium unknown. Fruit slightly depressed-globose, 2.7–3 mm long, 3–3.2 mm diam., inconspicuously pellucid punctate.

Distribution. Endemic to the cloud forests of Piura Province, 1,900–3,000 m elevation.

Paratypes. PERU. PIURA: Prov. Ayabaca, Frías, Las Pircas, 3,000 m, 17 Oct. 1988 (fr), *Díaz & Vásquez 3006* (AMAZ, MO, USM); Prov. Huancabamba, Dtto. Canchaque, road between Canchaque and Huancabamba, km 16 toward the left, Quebrada La Mina, 1,900 m, 17 Apr. 1987 (fr), *Díaz & Baldeón 2380* (AMAZ, MO, USM).

Myrsine reynelii is most closely related to *M. sodiroana* (Mez) Pipoly, but is easily recognized by its black punctate-lineate, revolute leaves, shorter cylindrical pedicels, and ovate, glabrous calyx lobes. *Myrsine sodiroana* is endemic to the cloud forests of Pichincha in Ecuador, while *M. reynelii* is endemic to the cloud forests of Piura in Peru. This species is dedicated to Carlos Reynel, professor of dendrology at the Universidad Nacional Agraria at La Molina, and currently a graduate student at the Missouri Botanical Garden.

Myrsine bullata Pipoly, sp. nov. TYPE: Peru. San Martín: Prov. Mariscal Cáceres, Río Abiseo National Park, nr. Puerta del Monte, 7°27′S, 77°21′W, 3,200 m, 7 Sep. 1985 (fr), *K. Young 1572* (holotype, MO; isotypes, F, USM). Figure 6.

Quoad laminas coriaceas ellipticas vel oblanceolatas bullatas insuper nitidas secus margines revolutas, lobos calycinis coriaceos ovatosque species haec ad *M. perreticulata* affinis, sed ab ea laminis subter pellucido-punctatis (non atro-punctato-lineatis) minute rufo glandulari-papillosis (nec adpresso-lepidotis) secus margines coriaceis opacis epunctatisque (nec cartaceis hyalinis aurantiaco-punctatisque), pedicellis 5–7 (non 2–4) mm longis, lobis calycinis planis (non carinatis) 1.4–1.7 (nec 2.5–2.8) mm longis ad apices acuminatis integerrimisque (nec obtusis erosisque) facile cognoscitur.

Tree to 13 m tall; branchlets terete, 3.5–5 mm diam., glabrous. Leaves coriaceous, elliptic to oblanceolate, (5.5–)9–15 cm long, (2–)3.5–4 cm wide, apex acute, base cuneate, decurrent on the petiole, costa impressed above, prominently raised below, secondary veins 12–15 pairs, impressed above, prominently raised below, bullate, nitid and glabrous above, minutely rufous glandular-papillate and inconspicuously pellucid-punctate below, the margin

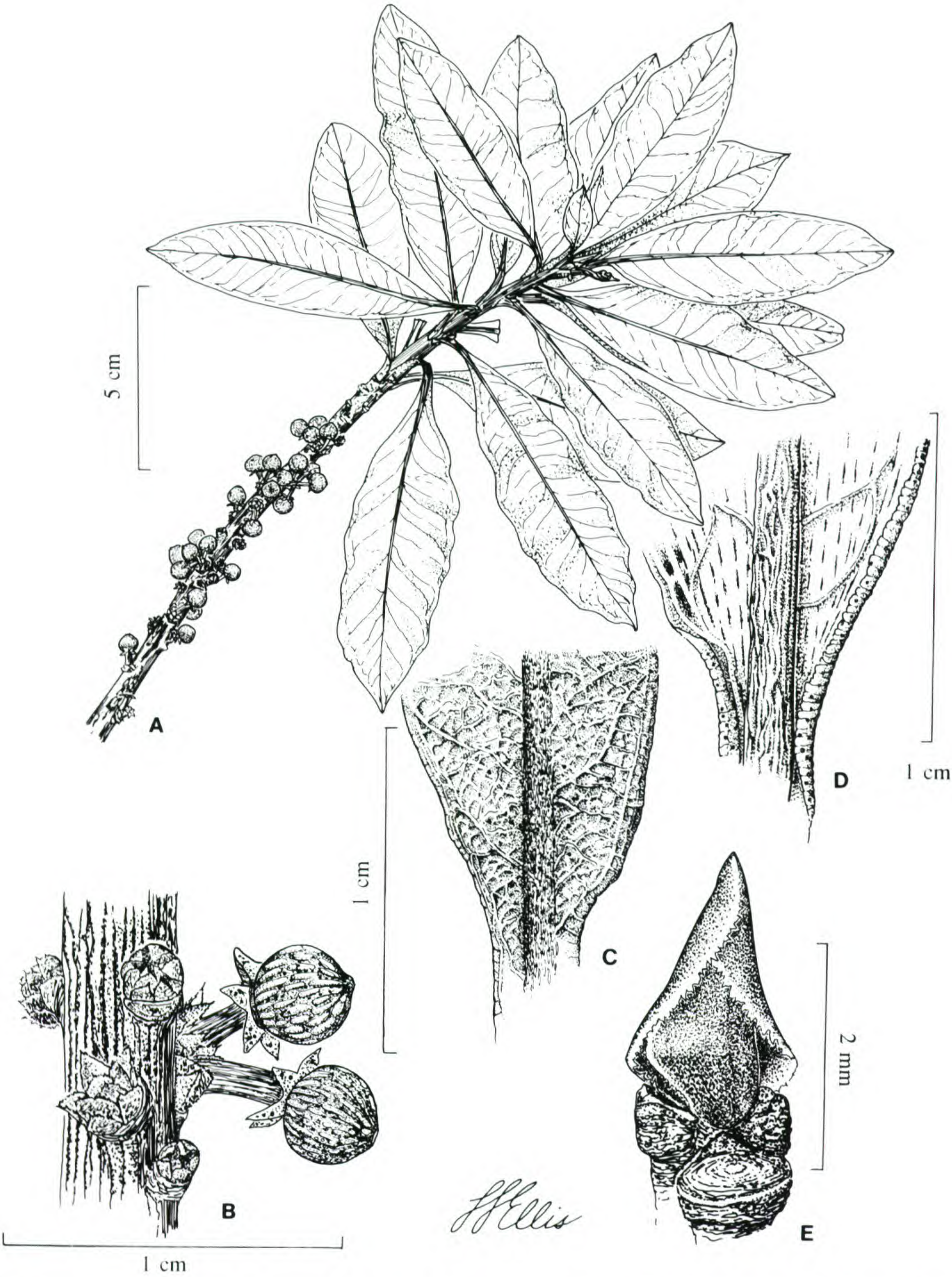

Figure 5. *Myrsine reynelii* Pipoly. —A. Habit. —B. Inflorescence, showing cylindrical pedicels and ovate, glabrous calyx lobes. —C. Adaxial leaf surface, showing scrobiculate, rugose surface. —D. Abaxial leaf surface, showing punctate lineations, revolute margin and marginate petiole. —E. Branchlet apex, showing bud texture and glandular-granulose margin. A–E, drawn from holotype.

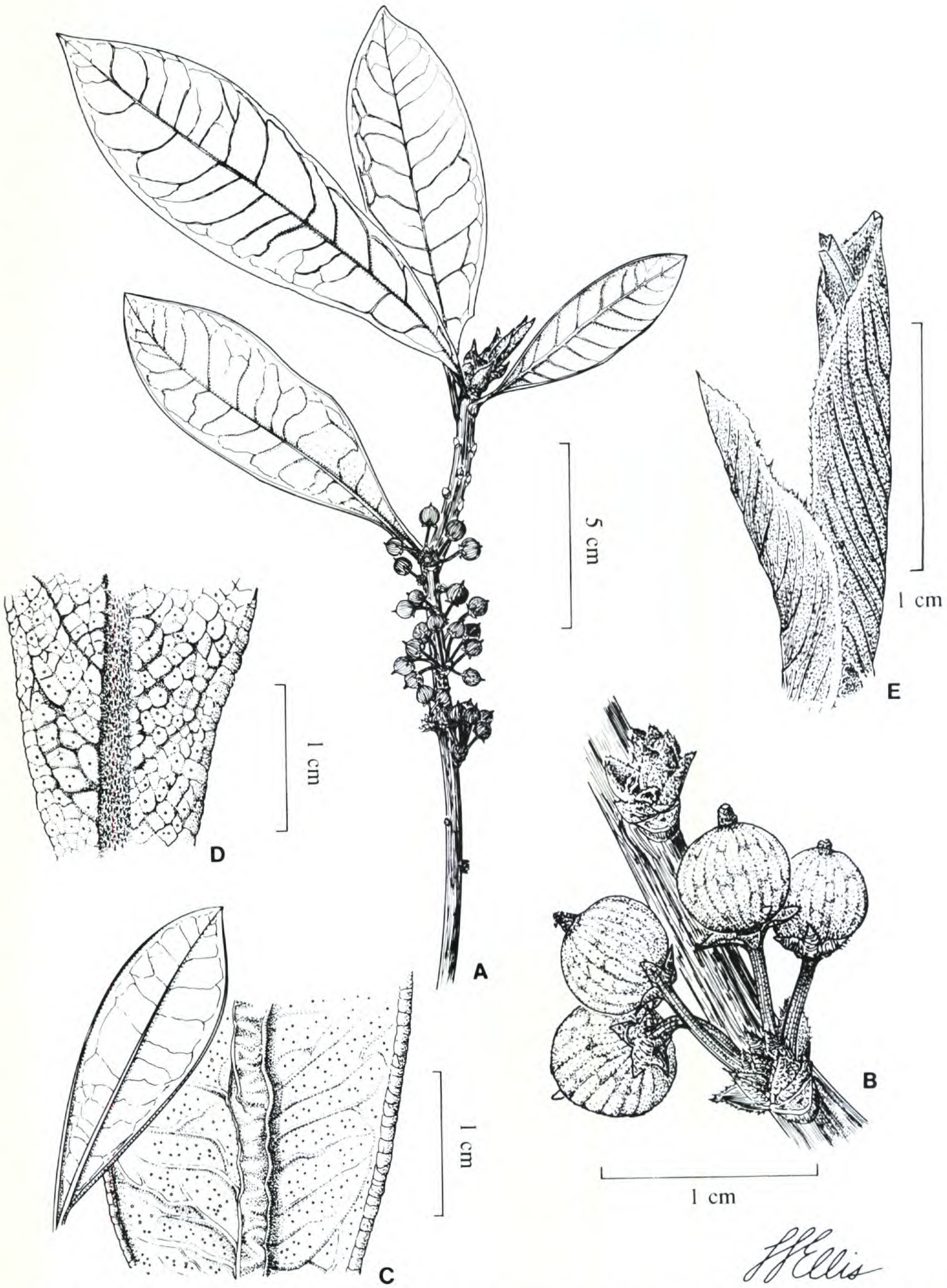

Figure 6. *Myrsine bullata* Pipoly. —A. Habit. —B. Infructescence, showing cylindrical pedicels and glandular-ciliate floral bract margins. —C. Abaxial leaf surface, showing minute rufous glandular papillae and revolute margin. —D. Adaxial leaf surface. —E. Branchlet apex, showing glandular-ciliate leaf bud margin. A–E, drawn from holotype.

opaque, epunctate, entire, revolute, and glabrous in bud and at maturity; petioles marginate, 0.5–0.8 cm long, glabrous. *Staminate inflorescence:* unknown. *Pistillate inflorescence:* a sessile umbel, 7–10-flowered; floral bracts coriaceous, ovate, 2.2–2.6 mm long, 0.8–1 mm wide, the apex acuminate, the margin opaque, entire, densely glandular-ciliate; pedicels cylindrical, 5–7 mm long, glabrous. Fruiting calyx 5-merous, coriaceous, cotyliform, 1.4–1.7 mm long, the tube ca. 0.2–0.3 mm long, the lobes ovate, 1.2–1.4 mm long, 0.9–1.2 mm wide, apex acuminate, inconspicuously pellucid punctate, sparsely red-papillate, the margin entire, glabrous; corolla, androecium and gynoecium unknown. Fruit depressed-globose, 4.8–5.1 mm long, 5.1–6 mm diam., purple, inconspicuously pellucid-punctate.

Distribution. Endemic to the Mariscal Cáceres Province, of San Martín Department, Peru, at the upper limit of montane rainforest with cloud forest, 3,200–3,400 m.

Paratype. PERU. SAN MARTIN: Prov. Mariscal Cáceres, Río Abiseo National Park, 7°00′S, 77°00′W, NW corner of Park, Chochos, S side of river, 3,400 m, 7 June 1986 (fr), *Young 3721* (F, US, USM).

Myrsine bullata is the sister species of *M. perreticulata* Pipoly, but is easily separated from it by the pellucid-punctate and minutely rufous glandular-papillate abaxial leaf surface, the coriaceous, opaque and epunctate leaf margins, longer pedicels and flat, acuminate calyx lobes with entire margins. The specific epithet refers to the prominently bullate character of the leaf blades.

Myrsine youngii Pipoly, sp. nov. TYPE: Peru. San Martín: Prov. Mariscal Cáceres, Río Abiseo National Park, NW corner, Puerta del Monte, trail to el Mirador, 7°00′S, 77°00′W, 3,100–3,300 m, 11 July 1987 (fr), *Young & León 4495* (holotype, F; isotypes, US, USM). Figure 7.

Ob laminas anguste oblanceolatas vel ellipticas, punctatas atque punctato-lineatas, ad apices acutas, etiam petiolos marginatos, *M. pellucido-punctatae* et *M. diazii* simulans, sed species haec ab ambabus ramulis translucido-papillatis (non glabris), laminis coriaceis (non membranaceis) secus margines manifeste revolutis (nec planis nec subrevolutis) parce et minute translucido-papillatis (nec glabris), lobis calycinis coriaceis (non chartaceis) ovatis (nec ovato-triangularibus) ad apices acuminatis (nec acutis) atque epunctatis (nec punctatis), stylo 0.2–0.3 mm longo (non obsoleto), ulterius a prima ramulis 2.5–3.5 (non 6–8) mm diametro, inflorescentiis subsessilibus (non ramulis brevibus insidentibus), stigmatibus 0.5–0.7 (non 1–1.4) mm longis, a secunda ramulis teretibus (non angulatis) petiolis 0.7–1 (non 0.3–0.6) cm longis, pedicellis teretibus (non angulatis) 2–3 (nec 0.5–1) mm longis, atque stigmatibus sinuato-lobulatis (non conicis) praeclare distinguitur.

Tree to 12 m; branchlets terete, 2.5–3.5 mm diam., translucent glandular-papillate apically. Leaves coriaceous, elliptic to oblanceolate, 3.5–5 cm long, 1.5–2 cm wide, apex acute, base cuneate, decurrent on the petiole, costa impressed above, prominently raised below, secondary veins inconspicuous, 8–12 pairs, sparsely translucent glandular-papillate above, densely at first, then sparsely minutely translucent glandular-papillate and black punctate and punctate-lineate below, the margin opaque, epunctate, entire, revolute, densely ciliate in bud, glabrous at maturity; petioles marginate, 0.7–1 cm long, glabrous. *Staminate inflorescence:* unknown. *Pistillate inflorescence:* a subsessile fascicle, 5–8-flowered; floral bracts coriaceous, very widely ovate, 1–1.5 mm long, 1.3–1.5 mm wide, the apex acuminate, the margin opaque, entire, densely glandular-ciliate; pedicels cylindrical, 2–3 mm long, glabrous. Fruiting calyx 5-merous, coriaceous, cotyliform, 1.2–1.5 mm long, the tube ca. 0.1–0.2 mm long, the lobes ovate, 1.2–1.3 mm long, 0.6–0.9 mm wide, apex acuminate, inconspicuously pellucid punctate, glabrous, the margin entire, glandular-ciliate; corolla, androecium and gynoecium unknown except persistent style 0.2–0.3 mm long, the stigma sinuate-lobed, 0.5–0.7 mm long. Fruit globose, 2.7–3 mm long, 2.5–2.8 mm diam., prominently black punctate.

Distribution. Known only from the type.

Myrsine youngii is closely related to *M. pellucido-punctata* and *M. diazii*, but is readily separated from both by the translucent papillate branchlets, the coriaceous, revolute, and sparsely translucent papillate leaves, the coriaceous, ovate and acuminate calyx lobes, and the lobed stigma on a style. Furthermore, *M. youngii* is distinguished from *M. pellucido-punctata* by the thinner branchlets, subsessile inflorescence, and smaller stigma, while from *M. diazii* it is clearly separated by the terete branchlets, longer petioles, terete and longer pedicels, and sinuate-lobulate stigma. The presence of a style in *Myrsine youngii* once again reinforces the concept that maintenance of *Rapanea* Aublet as distinct from *Myrsine* L. is untenable. This species is dedicated to Ken Young, phytogeographer and floristician, whose excellent collections and papers on Peruvian "ceja de selva" have proven very valuable in furthering its study and conservation.

Myrsine minutiflora Pipoly, sp. nov. TYPE: Peru. Lambayeque: Prov. Ferreñafe, Bosque de Chiñama, 2,300–2,700 m, 15 Aug. 1988 (stam. fl), *Valencia 2379* (holotype, US; isotype, USM). Figure 8.

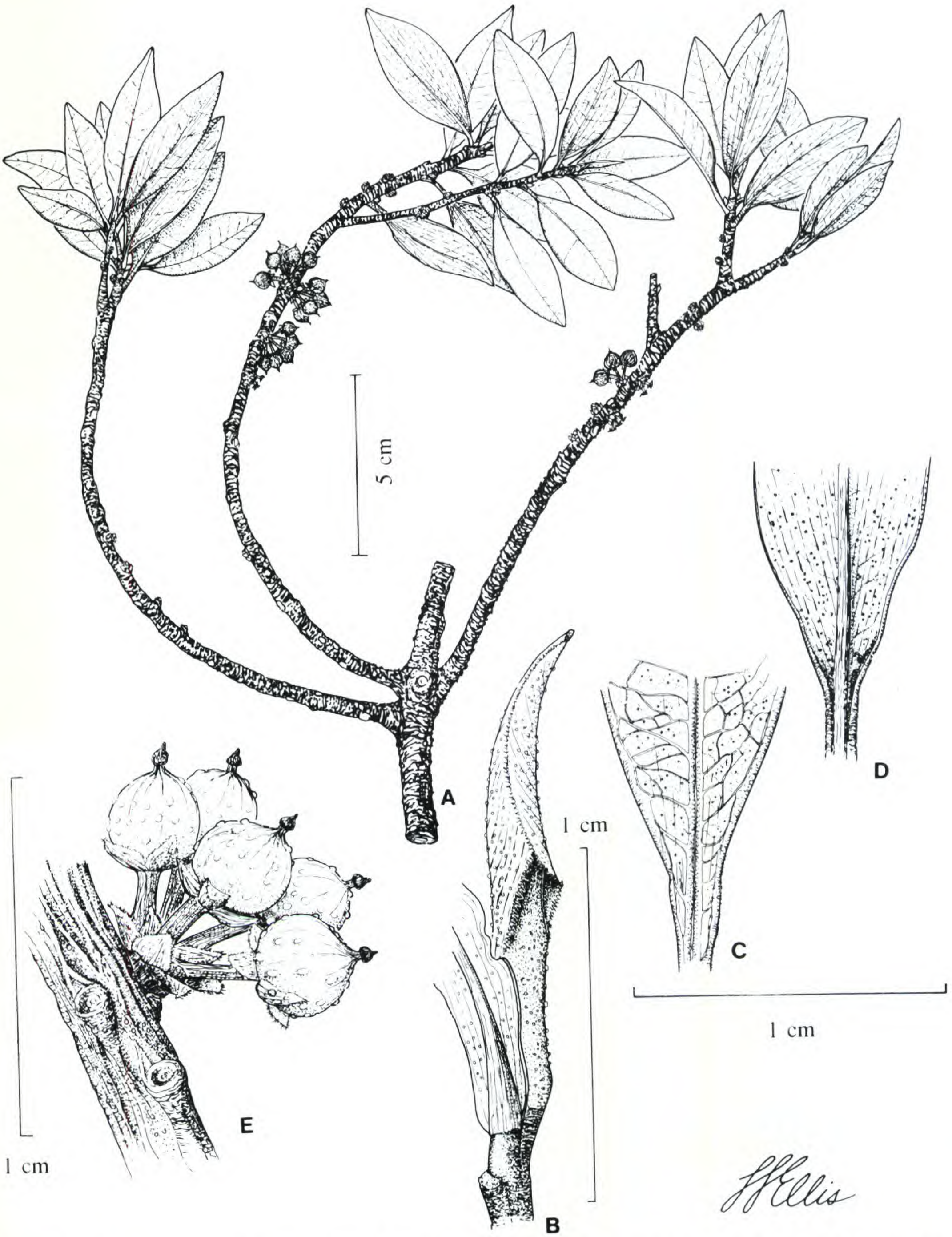

Figure 7. *Myrsine youngii* Pipoly. —A. Habit, showing subsucculent branchlets. —B. Branchlet apex, showing glandular-papillate leaf buds with margins glandular-ciliate. —C. Adaxial leaf surface. —D. Abaxial leaf surface, showing translucent glandular-papillae. —E. Pistillate infructescence, showing fruit, persistent style and sinuate-lobed stigma. A–E, drawn from holotype.

Quoad ramulos glabros, folia coriacea elliptica vel oblanceolata ad apices acuta vel obtusa, inflorescentia sessilia fasciculataque, pedicellos breves, species haec cum *M. pellucida* saepenumero confusa est, sed ab ea floris staminatae corollis 1.8–2 (non 2.5–2.7) mm longis, pedicellis 1–1.2 (non minus quam 1) mm longis, pistillodio costato (non tereti), floris pistillatae calycis lobis acuminatis (non rotundatis) secus margines glandulari-ciliolatis (nec glabris), pedicellis 1.5–1.7 mm longis (non obsoletis), denique stigmate conico (nec lobulado) statim separabilis.

Tree, height unknown; branchlets angulate, 3.5–4.5 mm diam., prominently red punctate, glabrous. Leaves coriaceous, elliptic to oblanceolate, (4.2–)5–

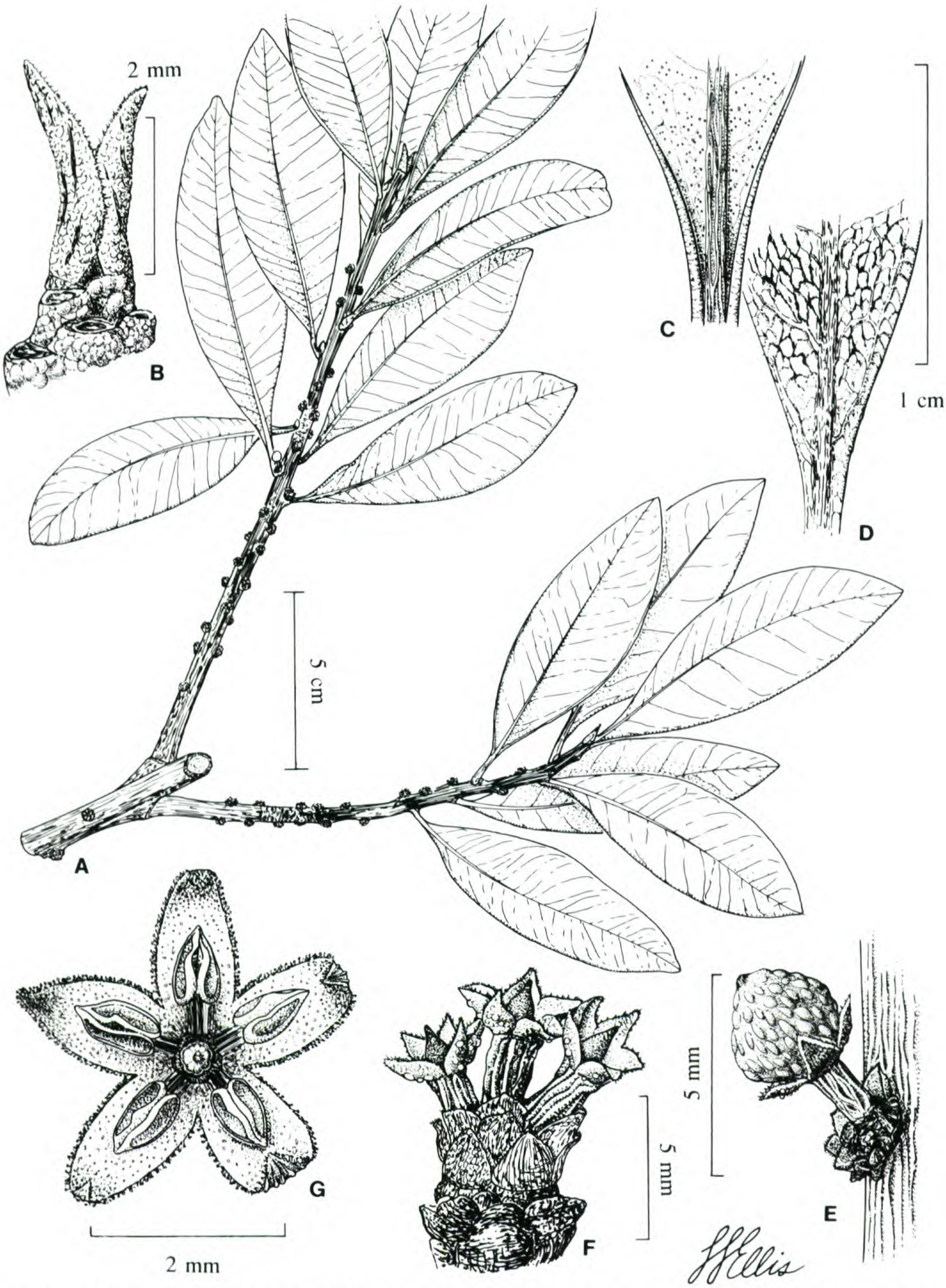

Figure 8. *Myrsine minutiflora* Pipoly. A–D, F–G drawn from holotype, E drawn from *Valencia 2248*. —A. Habit, showing angulate branchlets. —B. Branchlet apex, showing punctations on leaf bud and stem. —C. Abaxial leaf surface, showing black punctate lineations and marginate petiole. —D. Adaxial leaf surface. —E. Infructescence, showing calyx and fruit. —F. Staminate inflorescence. —G. Staminate flower, showing costate pistillode.

7(–9) cm long, (1.9–)2.5–3 cm wide, apex acute to obtuse, base cuneate, decurrent on the petiole, costa impressed above, prominently raised below, secondary veins inconspicuous, 13–15 pairs, red perpuncticulose and black punctate-lineate below, the margin opaque, epunctate, entire, flat, densely ciliate in bud, glabrous at maturity; petioles marginate, 0.7–1 cm long, glabrous. *Staminate inflorescence:* a sessile fasicle, 3–6-flowered; floral bracts coriaceous, widely ovate, 0.7–0.8 mm long, 0.7–0.9 mm wide, apex obtuse to subacute, the margin entire, glabrous; pedicels angulate, 1–1.2 mm long, glabrous. Flowers 5-merous, green; calyx coriaceous, cotyliform, 0.7–1 mm long, the tube ca. 0.2 mm long, the lobes ovate, 0.5–0.8 mm long, 0.3–0.5 mm wide, apex acuminate, somewhat cucullate, densely and prominently red punctate, the margin densely glandular-ciliolate; corolla coriaceous, subrotate, 1.8–2 mm long, the tube ca. 0.6 mm long, the lobes ovate, 1.2–1.4 mm long, 0.7–0.9 mm wide, apex subacuminate and proximally recurved, inconspicuously pellucid-punctate and glabrous without, densely glandular-granulose throughout within, the margin opaque, densely glandular-ciliate; stamens 1–1.2 mm long, the filaments conspicuous, flat, 0.2–0.4 mm long, the anthers ovate, 0.7–0.9 mm long, 0.4–0.6 mm wide, apex apiculate, base deeply cordate, the connective epunctate, glabrous; pistillode ovoid, 1–1.2 mm long, 0.3–0.4 mm diam., prominently costate, hollow, the stigma punctiform. *Pistillate inflorescence:* a sessile fasicle, 3–5-flowered; floral bracts coriaceous, widely ovate, 0.7–1 mm long, 0.8–1 mm wide, apex acute, the margin entire, glabrous; pedicels angulate, 1.5–1.7 mm long, glabrous. Fruiting calyx 5-merous, coriaceous, cotyliform, 1.3–1.5 mm long, the tube ca. 0.2 mm long, the lobes ovate, 1.1–1.3 mm long, 1.1–1.2 mm wide, apex acuminate, somewhat cucullate, densely and prominently red punctate, the margin densely glandular-ciliolate; corolla, androecium and gynoecium unknown. Fruit subglobose, 3–3.5 mm long and in diam., densely and prominently red-punctate; persistent stigma conical, ca. 0.1–0.2 mm long.

Distribution. Endemic to the western slopes of the Peruvian Andes in the departments of Lambayeque, Piura, and La Libertad, at 2,300–2,950 m.

Paratypes. PERU. LA LIBERTAD: Prov. Otuzco, Bosque de Llaguen, 2,500–2,800 m, 5 Nov. 1988 (ster.), *Cano 2378* (US, USM); Prov. Ferreñafe, Bosque de Chiñama, 2,300–2,700 m, 15 Aug. 1988 (pist. fr), *Valencia 2248* (US, USM). PIURA: Prov. Ayabaca, Bosque de Huamba, 2,850–2,950 m, 15 Oct. 1987 (ster.), *Cano 1514* (US, USM), (bud), *Valencia 2027* (US, USM).

Myrsine minutiflora has often been confused with *M. pellucida* (Ruíz & Pavón) A. Sprengel, but can at once be recognized by its staminate flowers with costate pistillode, with shorter corollas and pedicels. In addition, the longer pistillate pedicels, conic stigma and acuminate, glandular-ciliolate calyx lobes of *M. minutiflora* are distinctive. Both *Myrsine minutiflora* and *M. pellucida* have been confused with *M. guianensis* (Aublet) Kuntze and *M. latifolia* (Ruíz & Pavón) A. Sprengel, but bear only superficial vegetative resemblance to both. Aside from differences in floral morphology, *Myrsine minutiflora* is separated from *M. guianensis* by the sessile inflorescences (not on short shoots) on branchlets with thin (not corky) bark, and from *M. latifolia* by the fasciculate (not umbellate) inflorescences, smaller leaves, and shorter pedicels.

In addition to the novelties described above, treatment of *Rapanea* as a taxonomic synonym of *Myrsine* necessitates the following new combinations. Because Peruvian Myrsinaceae have long been poorly understood, I include citations of representative specimens when possible.

Myrsine sprucei (Mez) Pipoly, comb. nov. Basionym: *Rapanea sprucei* Mez in Engl., Pflanzenr. IV. 236(9): 388. 1902. TYPE: Peru. San Martín: Tarapoto, *Spruce 4251* (holotype, B destroyed; isotypes, K, G, G-DEL, OXF).

Distribution. Endemic to the lower eastern slopes of the Andes in Peruvian Amazonia, 2,400–2,500 m elevation.

Representative specimen examined. PERU. AMAZONAS: Prov. Chachapoyas, Cerros de Leimebamba, 2,400–2,500 m, 20 Apr. 1964 (fr), *Ferreyra 15594* (MO, USM).

Myrsine brevis (J. F. Macbr.) Pipoly, comb. nov. Basionym: *Rapanea brevis* J. F. Macbr., Candollea 5: 396. 1934. TYPE: Peru. La Libertad: Prov. Pataz, Tayabamba, 1900–1914 (fr), *Weberbauer 7025* (holotype, F).

Distribution. Endemic to the north-central region of the Peruvian Andes, 2,850–3,600 m.

Representative specimens examined. PERU. LA LIBERTAD: Prov. Pataz, Retamas–La Paccha, rd. to Tayabamba, 3,600 m, 24 June 1974 (stam. fl), *López & Sagástegui 8172* (HUT, MO).

Myrsine lechleri (Mez) Pipoly, comb. nov. Basionym: *Rapanea lechleri* Mez, Pflanzenr. IV. 236(9): 380. 1902. TYPE: Peru. Puno: Tatanara, *Lechler 2647* (holotype, K).

Distribution. Known only from the type.

Myrsine rivularis (Mez) Pipoly, comb. nov. Basionym: *Rapanea rivularis* Mez, Bull. Herb. Boissier 2 sér. 5: 536. 1905. TYPE: Peru. Puno: between Sandía and Tambo Azalayo, 1,500 m, *Weberbauer 1061* (holotype, B destroyed; fragment, F).

Distribution. Known only from the type.

Myrsine sessiliflora (Mez) Pipoly, comb. nov. Basionym: *Rapanea sessiliflora* Mez, Repert. Spec. Nov. Regni Veg. 3: 103. 1906. SYNTYPES: Peru. Amazonas: near Cuelap, near Chachapoyas, *Weberbauer 4324* (syntype, B destroyed; G-DEL, as photo at F, Neg. 26699). Cajamarca: Prov. Cajamarca, above San Pablo, 2,400 m, *Weberbauer 3810* (syntype, B destroyed; fragment, F); Prov. Chota, between Huambos and Montán, 2,500–2,600 m, *Weberbauer 4216, 4217* (syntypes, B destroyed).

I have not seen the isosyntype of *Weberbauer 3810* at G-DEL, but the type photo leaves no doubt as to the identity of this species.

Distribution. Endemic to the eastern slopes of the eastern Andean cordillera of Cajamarca, Huánuco, San Martín and Amazonas, Peru, in cloud and elfin forests, 1,960–3,500 m.

This species has been poorly understood, but is at once recognized by it sessile, few-flowered, fasciculate inflorescences, flexuous, ridged branchlets, and patelliform calyces.

Representative specimens examined. PERU. AMAZONAS: Leimebamba, 2,300 m, 20 Dec. 1962 (fr), *Woytkowski 7780* (MO). CAJAMARCA: Prov. Cajamarca, road between Cajamarca and Celendín, 2,950–3,500 m (pist. fl, fr), *Díaz 2161* (CPUN, MO, USM); below Paso Gavilán before Chotén, 2,800–2,850 m, 11 Feb. 1987 (fr), *Sánchez 4210* (CPUN, MO); 50–60 km E of bridge over río Maichil, 6°28′S, 79°00′W, 2,500–2,600 m, 9 Feb. 1988 (pist. fl, fr), *Gentry et al. 61437* (CPUN, MO, USM); Prov. Celendín, Celendín–Balsas Rd., 3–10 km from Celendín, 6°52′S, 78°07′W, 2,700–2,900 m, 16 July 1983 (fr), *D. Smith & Sánchez 4303* (MO, USM); Prov. Chota, Llama, caserío Callampampa, tributary of Río Huarimarca, 2,800–3,000 m, 19 Jan. 1990 (pist. fl, fr), *Díaz & Osores 4013* (AMAZ, CPUN, F, MO, US, USM); Prov. Contumazá, 10–11 km from Contumazá on rd. to Cascas, 7°25′S, 78°50′W, 2,550 m, 7 Feb. 1987 (pist. fl, fr), *Stein et al. 4045* (CPUN, MO, USM); Lledén, 2,400 m, 28 June 1983 (fr), *Sagástegui et al. 10844* (HUT, MO, NY, USM); San Martín, between Singarrán and Lledén, 2,900 m, 1 June 1979 (pist. fl), *Sagástegui et al. 9347* (HUT, MO); Prov. Hualgayoc, Tahona, between Bambamarca and Hualgayoc, 2,900–3,000 m, 16 Aug. 1952 (bud), *Ferreyra 8509* (MO, USM).

Myrsine weberbaueri (Mez) Pipoly, comb. nov. Basionym: *Rapanea weberbaueri* Mez, Repert. Spec. Nov. Regni Veg. 3: 103. 1906. SYNTYPES: Peru. Huánuco: Prov. Huamalies, nr. Monzón, 1,000–1,500 m, (stam. fl), *Weberbauer 3457*, (pist. fl), *3462* (syntypes, B destroyed, F Neg. 4895).

Lectotypification is postponed until isosyntypes are located.

Distribution. Endemic to the Huánuco area of the north-central Andean cordillera of Peru, 800–1,500 m.

Representative specimen examined. PERU. HUANUCO: Prov. Leoncio Prado, Dtto. Rupa Rupa, E of Tingo María, nr. Cerro Quemado, 800–850 m, 15 Aug. 1978 (fr), *Schunke 10488* (F, MO).

Upon examining specimens of non-Peruvian *Myrsine* species, the following other new combinations have come to light.

Myrsine sodiroana (Mez) Pipoly, comb. nov. Basionym: *Rapanea sodiroana* Mez in Engl., Pflanzenr. IV. 236(9): 385. 1902. TYPE: Ecuador. Pichincha: without locality, *Sodiro 1003* (holotype, B destroyed; F Neg. 4892).

Despite the fact that the holotype of this species was destroyed in Berlin, the photograph at F permits positive identification.

Distribution. At present known only from Pichincha, Ecuador, at 1,500–3,500 m.

Representative specimens examined. ECUADOR. LOJA/ZAMORA–CHINCHIPE: Parque Nacional Podocarpus, Yangana Valladolid, Nudo de Sabanilla, 4°27′S, 79°08′W, 2,750–2,900 m, 28 Feb. 1985 (fr), *Øllgaard et al. 58407* (AAU, QCA). PICHINCHA: Cantón Quito, Parroquia Calacali, Reserva Geobotánica Pululahua, Road to Moras Pungo, 00°05′N, 78°30′W, 1,800–3,356 m, 23 Aug. 1987 (fr), *Cerón & Benavídez 1919* (MO, QCA).

Myrsine pseudocrenata (Mez) Pipoly, comb. nov. Basionym: *Rapanea pseudocrenata* Mez in Engl., Pflanzenr. IV. 236(9): 393. 1902. TYPE: Bolivia. Sorata, Cochipata on Río Uleumauni, 3,000–3,200 m, *Mandon 545* (holotype, B destroyed; F Neg. 4891).

Distribution. Known only from Bolivia, but expected in Puno, 2,500–3,500 m.

Representative specimens examined. BOLIVIA. COCHABAMBA: Prov. Carrasco, 5 km E of bridge over Río López Mendoza, on Cochabamba–Santa Cruz Rd., 19 km W of Epizana, 17°32′S, 65°22′W, 2,900 m, 11 Feb. 1987 (fr), *Solomon & Nee 16050* (LPB, MO, NY, US). LA PAZ: Prov. Sud Yungas, below Unduavi, Cerromarca Valley, 3,450 m, 28 Aug. 1988 (stam. fl), *Beck 14682* (LBP, MO, US).

Myrsine congesta (Schwacke ex Mez) Pipoly, comb. nov. Basionym: *Rapanea congesta* Schwacke ex Mez in Engl., Pflanzenr. IV. 236(9): 383. 1902. SYNTYPES: Brazil. Minas Gerais: Serra do Ouro-Preto, *Gomes 1273* (syntype, M—as Photo F, Neg. 20074). Rio de Janeiro: near Petropolis on Morro Carangola, *Glaziou 14044* (syntype, C—as Photo, F Neg. 22973; isosyntype, RB).

I defer lectotypification until all syntypes have been studied.

Distribution. Minas Gerais and Rio de Janeiro, Brazil.

Myrsine lehmannii (Standley) Pipoly, comb. nov. Basionym: *Rapanea lehmnannii* Standley, Publ. Field Mus. Nat. Hist., Bot. Ser. 11: 170. 1936. TYPE: Colombia. Cauca: Páramo Las Delicias, Central Andes of Popayán, *Lehmann 8459* (holotype, F).

Distribution. Endemic to the western slopes of the Central Cordillera of Colombia, in the general area of the Macizo Colombiano.

This species is apparently endemic to the slopes of the western Andean cordillera in Colombia, but is very closely related to *Myrsine dilloniana*, a Peruvian species described herein.

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Adenophorus ×*carsonii* hyb. nov. (Grammitidaceae): A New Endemic Hybrid from the Island of Hawaii

Tom A. Ranker

University Museum and Department of Environmental, Population, and Organismic Biology, University of Colorado, Boulder, Colorado 80309-0350, U.S.A.

ABSTRACT. A new hybrid between two species of the endemic Hawaiian genus *Adenophorus* is described. On morphological grounds it appears to be a hybrid between *A. hymenophylloides* and *A. tripinnatifidus*. That hypothesis is supported by preliminary isozyme data, which also demonstrate that different individuals were produced by separate hybridization events. The irregular size and shape of spores and lack of complete pairing of meiotic chromosomes indicate that the hybrid is infertile.

Adenophorus Gaudich. is an endemic Hawaiian genus comprising two subgenera, *Adenophorus* (6 species) and *Oligadenus* L. E. Bishop (4 species; Bishop, 1974). Most members of the genus are widespread on the main Hawaiian Islands, although *A. haalilioanus* (Brack.) K. A. Wilson is restricted to Kauai and Oahu, and *A. oahuensis* (Copel.) L. E. Bishop only occurs on Oahu. *Adenophorus periens* L. E. Bishop is known only from a few locations on Kauai, Hawaii, and Molokai. Most species are obligate epiphytes occurring in habitats ranging from montane mesic to wet forests. Although Bishop (1974) described a hybrid between *A. oahuensis* and *A. pinnatifidus* Gaudich., both in subgenus *Oligadenus*, the hybrid I present here is the first report of a naturally occurring hybrid between two species in subgenus *Adenophorus*.

Adenophorus ×carsonii Ranker, hyb. nov.

TYPE: U.S.A. Hawaii: Island of Hawaii, Puna District, Kahaualea Natural Area Reserve, 5.6 km S of Hwy. 11 at end of South Glenwood Rd., 700 m, 6 June 1990, *Ranker 1115* (holotype, BM; isotype, COLO). Figure 1.

Rhizomata breviter reptantia; paleae elongato-lanceolatae; folia 12–35 cm longa, pendula sed juvenilia erecta; lamina bipinnatifida; pinnae 5–15 cm longae; pinnulae basales et acroscopicae simplices vel pinnatifidae; sporae abortivae; planta inter *A. hymenophylloides* et *A. tripinnatifidus* intermedia.

Plants epiphytic; rhizome short-creeping, 2–4 mm diam.; rhizome scales 3–4 mm long, 0.3–0.5 mm wide, amber-colored, long-lanceolate, rounded to auriculate at base, subulate to slightly rounded at tip often bearing a glandular apical cell, occasionally branched near tip with an additional glandular cell at apex of branch; cells of rhizome scales rhomboid to fusiform, several to many times longer than wide; leaves mostly 12–25 cm long, occasionally up to 35 cm, 1.5–2.0 cm wide, erect when young but soon becoming pendulous as they mature, appearing tufted; stipe 0.3–0.5 mm diam., 1.0–2.0 cm long, slightly alate when young but not apparent on older stipes, sparsely to densely clothed with appressed glandular trichomes; blades bipinnatifid, linear, with appressed, glandular trichomes on both surfaces and rachis, tip long-tapering or abrupt; pinnae 5–15 mm long with 6–10 pinnules; pinnules mostly simple, spathulate, apex slightly rounded to acute, basal pinnules 2.0–7.0 mm long, 0.8–1.0 mm wide, becoming smaller toward tip of pinna, basal acroscopic pinnule often divided again; mature sori abaxial, about 1.0 mm diam., equaling the width of the fertile pinnule; sporangia with 12–15 annular cells; spores irregular and aborted.

Plants discovered to date only grow epiphytically on bryophyte-covered trunks of *Metrosideros polymorpha* Gaudich. (Myrtaceae) in forests dominated by a mixture of that species and the tree fern *Cibotium glaucum* (Smith) Hook. & Arn.

The epithet is in honor of Hampton L. Carson, University of Hawaii, who first recommended that I visit the Kahaualea Natural Area Reserve where the hybrid was first discovered.

Paratypes. U.S.A. HAWAII: Island of Hawaii, Puna District, same as *Ranker 1115* but collected on 27 May 1991, *Ranker 1202* (MICH, PTBG, US); forest NW of Volcano refuse transfer site and SE of Olaa tract of HVNP, 870–900 m, *Ranker (1315) & Trapp* (COLO).

The possible hybrid nature of *A.* ×*carsonii* was suggested on morphological grounds because of its similarity to both *A. hymenophylloides* and *A. tripinnatifidus*, its putative parents. *Adenophorus* ×*carsonii* differs from these two species in several morphological features and is usually approximately intermediate between them (Table 1, Fig. 1). The hybrid is most easily confused at first sight with *A.*

Figure 1. A–C. *Adenophorus* ×*carsonii* Ranker. —A. Entire plant. —B. Detail of abaxial surface of pinna. —C. Detail of abaxial surface of pinnule. —D. Abaxial surface of pinna of *A. hymenophylloides*. —E. Abaxial surface of pinna of *A. tripinnatifidus*.

hymenophylloides because of the pendulous habit of the leaves of both species. The broader and longer leaf blade, larger pinnae, and irregularly shaped spores of the hybrid (Table 1), however, readily allow for its distinction.

Material for chromosomal analyses was collected from the type locality. Meiotic behavior of chromosomes was observed following the methods of Haufler et al. (1985). An exact meiotic chromosome count could not be obtained because of the limited

TABLE 1. Comparison of *Adenophorus* ×*carsonii* with its putative parents, *A. hymenophylloides* and *A. tripinnatifidus*.

Character	*A. hymenophylloides*	*A.* ×*carsonii*	*A. tripinnatifidus*
Rhizome	Short	Short-creeping	Long-creeping
Rhizome scales	Sublinear	Long-lanceolate	Narrowly deltoid
Leaf length (cm)	2–15	12–35	8–50
Leaf habit	Pendulous	Erect when young, becoming pendulous	Erect, arching
Leaf blade	Sub- to deeply bipinnatifid	Bipinnatifid	Bi- to tripinnatifid
Pinnae length (mm)	2–10	5–15	10–60
Basal, acroscopic pinnule	Simple	Simple to bifid	Simple to pinnatifid, with up to 10 lobes

amount of material available and due to irregular pairing at diakinesis. Several of the chromosomes appeared to be univalents, and the total number of meiotic figures was greater than would be expected in a normally pairing diploid in this genus (i.e., 37 pairs) and fewer than would be expected in a triploid or higher polyploid. *Adenophorus* ×*carsonii* therefore appears to be an infertile diploid.

Preliminary isozyme data (following Ranker et al., 1989) were obtained from the limited amount of material collected (i.e., four individuals; Ranker, unpublished data). At 10 of the 14 loci scored, the two parental taxa and their putative hybrid were invariant for the same allele. At the remaining loci, hybrid individuals were heterozygous and shared alleles with at least one parent. At the latter group of loci, however, parental taxa were highly variable (Ranker, 1992), and alleles present in the hybrid were not always detected in the individual parental plants examined. A more detailed analysis is necessary, therefore, to attempt to sample more of the allelic variability present in the potential parental taxa. Each of the four hybrids sampled possessed a unique genotype at each of several loci, indicating that separate hybridization events were responsible for the origin of each plant.

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Additions to *Aequatorium* and *Gynoxys* (Asteraceae: Senecioneae) in Bolivia, Ecuador, and Peru

Harold Robinson and José Cuatrecasas

Department of Botany, National Museum of Natural History, Smithsonian Institution, Washington, D.C. 20560, U.S.A.

ABSTRACT. *Gynoxys carpishensis*, *G. rimachiana*, and *Senecio tuestae* are transferred to *Aequatorium*, *Gynoxys regis* is transferred to *Paragynoxys*, and *Aequatorium cajamarcense*, *A. juninense*, *A. kingii*, *A. tovarii*, *Gynoxys chingualensis*, *G. jaramilloi*, and *G. hutchisonii* are described as new.

Specimens submitted for identification over the years include the following four undescribed species of *Aequatorium* B. Nord. and three undescribed species of *Gynoxys* Cass. from Bolivia, Ecuador, and Peru. Two Peruvian species are transferred from *Gynoxys* to *Aequatorium*, one Peruvian species is transferred from *Senecio* to *Aequatorium*, and an Ecuadorian species is transferred from *Gynoxys* to *Paragynoxys* (Cuatrec.) Cuatrec. These are in addition to results of many separate papers providing recent descriptions and additions in *Aequatorium* (Nordenstam, 1978; Díaz-Piedrahíta & Cuatrecasas, 1990; Jeffrey, 1992) and *Gynoxys* (Sagástegui & Dillon, 1985; Dillon & Sagástegui, 1988; Funk & Robinson, 1989; Herrera, A., 1980; Robinson & Cuatrecasas, 1984; Sagástegui & Tellez-Alvarado, 1987).

Aequatorium cajamarcense H. Robinson & J. Cuatrecasas, sp. nov. TYPE: Peru. Cajamarca: Prov. Cutervo, Distrito San Andrés de Cutervo, Parque Nacional de Cutervo, caserío "Pajonal," camino hacia Jaén (Chorro blanco), 2,600 m, 10 ago. 1987, *Díaz & Osores 2585* (holotype, US; isotype, MO).

A speciebus ceteris hujus generis in foliis ellipticis abaxialiter subglabris distinctissimum.

Tree 18 m tall; internodes of young branches 0.8–30.0 cm long, glabrous or glabrescent with minute hairs near nodes, surface subcarnose, wrinkled when dry. Leaves opposite, petioles 1.0–2.5 cm long; blades subcoriaceous, elliptical, 6–12 cm long, 2–4 cm wide, base obtuse to shortly acute, margins remotely, minutely denticulate, apex acute to shortly and slightly acuminate, upper surface glabrous except for sparse, minute, granular hairs along veins, lower surface subglabrous with sparse granular hairs along veins and over surface, the hairs with short narrow bases, subglobular, with 1–3 short points; venation pinnate, with 8–11 veins on each side. Inflorescence terminal on branches, broadly corymbose with spreading, densely corymbose branches, ca. 6 cm high and 11 cm wide; peduncles 1–3 mm long, with dense, minute, granular pubescence. Heads ca. 6 mm high; calyculus with an occasional narrowly lanceolate bract; involucral bracts ca. 8, elliptical or oblong, 2.0–2.3 mm long, 1.0–1.2 mm wide, apices rounded, subglabrous outside, with sparse granular pubescence on median band. Rays ca. 3; corolla yellow, glabrous, tube ca. 1.5 mm long, limb elliptical, ca. 4 mm long, 1.5 mm wide. Disk florets ca. 5; corolla yellow, ca. 5.5 mm long, glabrous, tube ca. 2 mm long, throat narrowly campanulate, ca. 1 mm long, lobes ca. 2.5 mm long; anther collar ca. 0.35 mm long, anther thecae ca. 1.5 mm long, apical appendage ca. 0.4 mm long, 0.25 mm wide; tips of style branches rounded, with slightly longer papillae at the apex. Achenes ca. 1.8 mm long, subglabrous, with small, scattered, rounded, thin-walled, subsessile glands that lack evident septa; pappus ca. 4 mm long, with bristles in 1 crowded series, apices slightly but distinctly broadened. Pollen grains 37–40 μm diam.

The genus *Aequatorium* was established by Nordenstam in 1978 based on two species of Senecioneae distinguished from *Senecio* by stellate hairs, elongate disk corolla lobes, cylindrical anther collars, and continuous but centrally depressed stigmatic surfaces on the style branches. The species had some resemblance to the genus *Gynoxys* in spite of having alternate leaves and blunt style tips. Still, some subsequent additions to the *Aequatorium* (Díaz-Piedrahíta & Cuatrecasas, 1990; Jeffrey, 1992) have opposite or subopposite leaves and were originally described in *Gynoxys*. The new species is one of the members of the genus with opposite leaves, but it is most distinct in the very sparse pubescence on the lower leaf surfaces. The hairs are not truly stellate, but they are globular with 1–3 short points. Only *A. rimachiana* has pubescence on the abaxial

leaf surface that is sparse, but that pubescence is still much denser and more stellate, and the leaves of that species are alternate with larger blades. The new species is described as a tree 18 m tall, and as such may be the largest member of this shrubby and arborescent genus.

Aequatorium carpishense (Cuatrec.) H. Robinson & J. Cuatrecasas, comb. nov. Basionym: *Gynoxys carpishensis* Cuatrec., Brittonia 12: 185. 1960.

This species, from Carpish Pass in Huánuco, appears to be closest to *A. stellato-pilosum* (Greenm. ex Greenm. & Cuatrec.) Jeffrey from the Villcabamba region of Cuzco. The leaf blades of *A. carpishense* seem more obviously shallowly dentate with thicker and more persistent stellate pubescence on the undersurface.

Aequatorium juninense H. Robinson & J. Cuatrecasas, sp. nov. TYPE: Peru. Junín: Carpapata, above Huacapistana, 2,700–3,200 m, 7 June 1929, *Killip & Smith 24434* (holotype, US).

In caulibus sparse et distincte hirsutis et in laminis foliorum ellipticis et integris distinctissimum.

Shrubs 2–4 m tall, laxly branched; stems slightly deflected at the upper nodes, strongly ribbed, covered by dense yellowish tomentum of stellate hairs, sparsely hirsute above with long spreading hairs. Leaves alternate, petioles 2–3 cm long, surface similar to stems; blades elliptical, 7–14 cm long, 3.0–6.5 cm wide, base rounded, margins entire, apex shortly acute, upper surface dark green, with sparse, evanescent pubescence of stellate hairs, lower surface with loose tomentum of stellate, interlocking hairs only partially hiding the leaf surface; venation pinnate with ca. 10 spreading secondary veins on each side. Inflorescence terminal on branches, broadly corymbose, 11–14 cm high and 12–20 cm wide, with rather spreading branches; peduncles 2–8 mm long, rather densely stellate pubescent. Heads 9–10 mm high; subinvolucral and calycular bracts 1–2 mm long; involucral bracts ca. 8, 4–6 mm long, 1.5–2.0 mm wide, apices obtuse, glabrous outside. Ray florets 2 or 3, corolla yellow, glabrous, tube ca. 5 mm long, limb elliptical, ca. 10 mm long and 2.5 mm wide. Disk florets 7–9; corolla yellow, glabrous, tube ca. 3 mm long, throat narrowly campanulate, ca. 3 mm long, lobes narrowly triangular, ca. 1.8 mm long; anther collars ca. 0.5 mm long, thecae ca. 1.7 mm long, apical appendage ca. 0.6 mm long and 0.25 mm wide; style tips rounded, with short pencil of hairs. Achenes ca. 3.5 mm long, glabrous; pappus 5.0–5.5 mm long, apices not broadened. Pollen grains 35–37 μm diam.

Paratype. PERU. JUNIN: Carpapata, above Huacapistana, 2,700–3,200 m, 7 June 1929, *Killip & Smith 24402* (US).

The type and paratype specimens have the same basic label citing the habitat as edge of forest.

The new species seems closely related to *Aequatorium repandum* (Wedd.) Jeffrey in the general aspect, the number of florets in the head, and the comparatively short triangular lobes of the corolla, shorter than the corolla throat. *Aequatorium juninense* differs by the generally more elliptical leaf blades, and the less dense stellate pubescence on the undersurfaces not completely hiding the leaf surface. The younger stems show some erect spreading hairs similar to those of *A. kingii* described below, but the number of hairs is much less and they are not as obvious a key character. The pappus bristles are like those of *A. kingii* in the lack of broadened apices.

Aequatorium kingii H. Robinson & J. Cuatrecasas, sp. nov. TYPE: Bolivia. Cochabamba: 15 km from Colomi, on the road to Tunari, 10,600 ft., 7 Feb. 1978, *King & Bishop 7680* (holotype, US).

In caulibus grosse et dense hirsutis et in laminis foliorum oblongo-ovatis et in capitulis majoribus distinctissimum.

Trees or large shrubs 3 m tall; moderately branching; stems strongly ribbed, sulcate, densely covered with appressed tomentum of stellate hairs, also densely hirsute with stiff, spreading, yellowish hairs. Leaves alternate, petioles 10–25 mm long, surface similar to stems, with or without large, erect hairs; blades ovate-oblong, mostly 5–10 cm long and 2.5–5.5 cm wide, base shallowly but distinctly cordate, margins shallowly to strongly dentate, apex shortly acute, upper surface dark green, smooth, veinlets rarely slightly prominulous, subglabrous, with scattered, minute, evanescent, stellate hairs, lower surface with large, yellow, stellate, interlocking hairs, with or without denser underlayer of minute, whitish stellate hairs completely hiding surface; veins pinnate with 5–6 spreading secondary veins on each side which are more crowded and more spreading near base. Inflorescence terminal on branches, broadly corymbose with ascending branches, 6–9 cm high, 9–14 cm wide; peduncles 2–12 mm long, densely covered with grayish, stellate hairs. Heads 7–10 mm high; subinvolucral and few calycular bracts linear, 6–9 mm long, ca. 1 mm wide, glabrous or with few stellate hairs; involucral bracts 8, oblong, 7–10 mm long, 1.5–2.5 mm wide, narrowed above

with apices obtuse, glabrous outside. Ray florets 4 or 5; corolla yellow, glabrous, tube 6 mm long, limb elliptical, ca. 10 mm long and 3 mm wide. Disk florets 10–14; corolla yellow, glabrous, tube ca. 3.5 mm long, throat narrowly campanulate, 3.5–4.0 mm long, lobes narrowly triangular, ca. 1.8 mm long, 0.8 mm wide at base; anther collar ca. 0.5 mm long, thecae ca. 1.8 mm long, apical appendage 0.6–0.7 mm long, ca. 0.22 mm wide; tips of style branches rounded, with stout apical pencil of hairs. Achenes submature, ca. 2.5 mm long, glabrous; pappus ca. 7 mm long, in 2 series, apices not broadened. Pollen grains ca. 37 μm diam.

Paratypes. BOLIVIA. COCHABAMBA: 26 km from Comarapa, on road to Cochabamba, 8,500 ft., 5 Feb. 1978, *King & Bishop 7650* (US); Prov. Carrasco, 5 km al NE de Monte Punco por el camino a Sihuenca, 17°34′S 65°15′W, 2,700 m, 10 Mar. 1988, *Solomon & Nee 18067* (MO, US).

Aequatorium kingii seems most similar to *A. fabrisii* (Cabrera) Jeffrey of northern Argentina in the short bases of its leaf blades, the ascending branches of its inflorescences, and the 4 to 5 ray florets and 10 or more disk florets in the head. The new species is most distinct in the densely and stiffly hirsute condition of the stems, a feature seen to some extent elsewhere in the genus only in *A. juninense* described above. The three specimens of the present species all show leaf blades with slightly but broadly cordate bases unlike the narrowly cordate bases sometimes seen in *A. repanda* (Wedd.) Jeffrey, the obtuse to subtruncate bases illustrated for *A. fabrisii* (Cabrera, 1978), or the rounded bases seen in *A. juninense*. The type specimen of the new species lacks the dense layer of smaller hairs on the lower leaf surface that completely hides the surface, but such hairs are present in both paratypes.

Aequatorium rimachianum (Cuatrec.) H. Robinson & J. Cuatrecasas, comb. nov. Basionym: *Gynoxys rimachiana* Cuatrec., Phytologia 52: 164. 1982.

Sagástegui & Dillon (1985) noted the presence of three arborescent species of *Gynoxys* in the Carpish Pass area, including this and *G. carpishensis*. The third species mentioned, *Gynoxys congestiflora* Sagástegui & Dillon, has strictly opposite leaves, unbranched, contorted hairs, and more pointed style tips, and it is not an *Aequatorium*.

Aequatorium tovarii H. Robinson & J. Cuatrecasas, sp. nov. TYPE: Peru. Huancavelica: Prov. Tayacaja, Arriba de Marcavalle, entre Huachocolpa y Tintay, 3,300 m, 21 Apr. 1964, *Tovar 4781* (holotype, US).

In laminis foliorum oblanceolatis et in lobis corollae anguste oblongis distinctissimum.

Shrubs to 2 m high, moderately branched; stems terete, weakly ribbed, completely covered with dense, yellowish, appressed tomentum of stellate hairs. Leaves alternate, petioles 7–15 mm long; blades oblanceolate, mostly 8–13 cm long and 2.3–4.0 cm wide, widest near distal third or fourth, base narrowly rounded, margins subentire, with minute, remote denticulations, apex obtuse or shortly acute, upper surface dark green, with scarcely prominulous veinlets, subglabrous with few evanescent hairs, with larger, unbranched hairs on midvein; lower surface with dense tomentum of stellate hairs; venation pinnate with ca. 8 ascending secondary veins on each side. Inflorescences terminal on branches, rounded corymbose, with erect-spreading lower branches from axils of distal leaves; peduncles 1–7 mm long, densely stellate pubescent. Heads 9–10 mm high; calycular bracts ca. 5, linear, 1–2 mm long; involucral bracts ca. 8, oblong, ca. 6 mm long and 1.5–2.0 mm wide, apices obtuse, partially obscured outside by stellate hairs. Ray florets usually 3; corolla yellow, glabrous, tube ca. 5 mm long, limb elliptical, ca. 6 mm long and 2 mm wide. Disk florets ca. 7; corolla yellow, 8.0–8.3 mm long, tube 3.5–4.0 mm long, throat narrowly campanulate, ca. 2 mm long, lobes narrowly oblong, ca. 2.3 mm long; anther collar ca. 0.4 mm long; thecae ca. 1.7 mm long; apical appendage ca. 0.7 mm long and 0.27 mm wide; style tips rounded, with short apical pencil of hairs. Achenes submature, ca. 1.8 mm long, glabrous; pappus 6–7 mm long, with bristles in 2 series, apices slightly but distinctly broadened. Pollen grains ca. 33 μm diam.

Paratype. PERU. HUANCAVELICA: Prov. Tayacaja, Abajo de San Antonio, distrito de Surcubamba, 2,200 m, 27 abr. 1963, *Tovar 4252* (US).

The specimens are cited from "bosque con pajonal" and "bosque subxerófilo."

Aequatorium tovarii has the general appearance of *A. repandum* from Bolivia and southeasternmost Peru, but in the former the leaves are distinctly wider in the distal half, the secondary veins are more ascending, and the disk corolla lobes are narrowly oblong and longer than the corolla throat. The lobes are unlike the narrowly triangular lobes of the *A. repandum* group, and are like those of the more northern species of *Aequatorium*.

Aequatorium tuestae (Cuatrec.) H. Robinson & J. Cuatrecasas, comb. nov. Basionym: *Senecio tuestae* Cuatrec., Fieldiana 27: 46. 1951.

This species seems somewhat similar to large-leaved *A. carpishense* and *A. rimachianum*, but it lacks cordate bases on the leaf blades.

Gynoxys chingualensis H. Robinson & J. Cuatrecasas, sp. nov. TYPE: Ecuador. Sucumbíos: Páramo Mirador SW of Playón de San Francisco, S of Río Chingual headwaters, elev. 3,400–3,600 m, *King, Peterson & Judziewicz 10131* (holotype, US; isotypes, MO, K).

In foliis late oblongo-ovatis subsessilibus supra glabris distinctissimis.

Shrubs 3–4 m tall, moderately branching; stems densely brownish velutinous. Leaves opposite, petioles 1–2 mm long; leaf blades broadly oblong-ovate, 4.5–7.0 cm long, 3.0–4.3 cm wide, base shallowly cordate, margins entire with remote, mucronate dentations reflexed against lower surface, apices rounded, upper surface glabrous, with a reticulum of prominulous veinlets, lower surface with dense brown tomentum, with long, unbranched, sinuous hairs and some T-shaped hairs of similar diameter intermixed; venation pinnate, with 6–8 secondary veins on each side, widely forking about halfway to margin. Inflorescence terminal on branches, broadly corymbose with densely corymbose branches, ca. 9 cm high and 14 cm wide; peduncles 5–10 mm long, densely brownish tomentose. Heads ca. 12 mm high; below the heads 2–3 linear, tomentose bracts ca. 8 mm long; involucral bracts ca. 8, oblong, 8–9 mm long, 1.5–3.0 mm wide, obtuse to shortly acute, densely tomentose on exposed outer surfaces. Ray florets ca. 5; corolla yellow, tube 4 mm long, glabrous, limb ca. 11 mm long and 3 mm wide, pilosulous in basal sinus, otherwise glabrous. Disk florets ca. 12; corolla yellow, ca. 10 mm long, glabrous, tube 4.0–4.5 mm long, throat narrowly campanulate, ca. 3.5 mm long, lobes ca. 2 mm long, 0.8 mm wide at base; anther collar ca. 0.8 mm long, cylindrical; thecae ca. 2 mm long; apical appendage ovate-oblong, 0.8 mm long and 0.3 mm wide; style apex twice as long as wide to bases of apical hairs. Submature achenes ca. 2.5 mm long, glabrous; pappus ca. 8 mm long, bristles in 2 crowded series, apices distinctly enlarged with many rows of crowded cells.

The specimen was collected from a páramo with *Espeletia* and *Calamagrostis*.

The subsessile leaves of *Gynoxys chingualensis* resemble those of *G. hirsuta* Wedd. from Depto. Cundinamarca, Colombia, but the latter has a more diffuse inflorescence with fewer heads on more numerous leafy branches, a coarser grayish pubescence, and smooth upper leaf surfaces with evanescent hairs. The new species resembles *G. tomentosissima* Cuatrec. of Amazonas, Peru, in habit, but the latter has more angled stems, longer petioles to ca. 1 cm long, and larger leaf blades with auriculate bases and smooth upper surfaces thinly velutinous with yellowish hairs.

Gynoxys hutchisonii H. Robinson & J. Cuatrecasas, sp. nov. TYPE: Peru. Piura: above Huancabamba, road to Piura, 3,000 m, 10 Oct. 1957, *P. C. Hutchison 1609* (holotype, US).

In foliis parvis et in capitulis eradiatis distincta.

Shrubs 0.5–1.5 m tall, highly branched; stems terete, scarcely striated, densely pale yellowish tomentose. Leaves opposite, petioles 5–10 mm long; blades oblong, 1.5–3.0 cm long, 0.8–1.5 cm wide, base rounded to subtruncate, margins entire, apex rounded to slightly obtuse, upper surface glabrous except on midvein, essentially smooth, lower surface densely tomentose with pale yellowish, unbranched, sinuous hairs; venation pinnate, with 4 or 5 secondary veins on each side sometimes forked near margin. Inflorescences clustered in pyramidal groups on leafy branches and branchlets, branches rather densely to laxly corymbose; peduncles 2–10 mm long, densely tomentose. Heads 1.0–1.2 cm high; calyculus bulging without obvious bracts; involucral bracts ca. 8, oblong, ca. 5 mm long and 1.5 mm wide, apices shortly acute, densely tomentose on exposed outer surfaces. Ray florets lacking. Disk florets 5–12; corolla pale yellow, 7–8 mm long, glabrous, tube 2.0–2.5 mm long, throat narrowly campanulate, 3.0–3.5 mm long, lobes ca. 1.8 mm long, ca. 0.7 mm wide at base; anther collar ca. 0.6 mm long, thecae ca. 1.2 mm long, apical appendage ca. 0.6 mm long and 0.25 mm wide; apex of style twice as long as wide to base of apical hairs. Achenes 2.5–3.0 mm long, glabrous; pappus in 2 crowded series, 6–8 mm long, distinctly broadened at tips. Pollen grains ca. 37 μm diam.

Paratype. PERU. AMAZONAS: Prov. Chachapoyas: Cerros de Calla-Calla, near km 403–407 of Balsas–Leimebamba road, 3,400–3,550 m, 18 Aug. 1962, *J. J. Wurdack 1702* (US).

Gynoxys hutchisonii is distinct in the combination of the small leaves and the rayless heads. Such small leaves are not found in other Peruvian species (Herrera, A., 1980; Sagástegui & Tellez-Alvarado, 1987; Dillon & Sagástegui, 1988), while the many small-leaved species of Ecuador all have rays. The rayless condition might occur occasionally in normally radiate species of *Gynoxys*, but a number of species are characteristically rayless. One group without rays and with glabrous involucral bracts is

represented in Peru by *G. soukupii* Cuatrec. Also rayless is the Peruvian *G. longifolia* Wedd., with its unusually long and slender leaves and somewhat axillary inflorescences.

The two specimens of the new species differ somewhat in appearance. The paratype is more branched and has more flexuous stems. The paratype also has generally longer peduncles and has 5–10 florets in the heads. The holotype has peduncles under 5 mm long and mostly 10–12 florets in the heads.

Gynoxys jaramilloi H. Robinson & J. Cuatrecasas, sp. nov. TYPE: Ecuador. Loja: Loma del Oro, 2,800–3,200 m, without date, *Jaramillo, Zak & Valencia 8799* (holotype, US; isotype, QCA).

In floribus femineis redactis et in pilis crassis contortis et in pilis pagina abaxiale foliorum valde biformibus distinctissima.

Shrubs 5 m high, with many short branches; stems terete with low ribs, bearing numerous, coarse, contorted, retrorse hairs, without underlayer of hairs, stem surface visible between hairs. Leaves opposite, petioles 0.5–1.0 cm long, slender, with erect hairs; blades oblong, mostly 3.0–4.5 cm long, 1.2–2.2 cm wide, base subtruncate to rounded, margins slightly sinuous, with minute, remote, mucronate denticulations reflexed against lower surface, apex rounded to obtuse, upper surface with secondary veins and some tertiary veinlets slightly prominulous, subglabrous, with sparse, evanescent, coarse, contorted hairs, lower surface densely yellowish tomentose, with coarse, contorted hairs underlain with fine tomentum of small T-shaped hairs; venation pinnate, with 5–6 secondary veins on each side, often forked halfway to margin. Inflorescence with small groups terminal on branches and branchlets, pyramidal with corymbose branches, 3–4 cm high and 3–5 cm wide; peduncles 5–13 mm long, densely tomentose with contorted, brown hairs. Heads ca. 1 cm high; subinvolucral and calycular bracts few, short, linear, 1.5–2.5 mm long; involucral bracts ca. 8, oblong, ca. 6 mm long and 1.5–2.0 mm wide, apices obtuse to shortly acute, densely tomentose outside on exposed surfaces. Female florets 2–3; corolla yellow, in form of small ray with 3 lobes or disciform with 5 lobes, glabrous, tube 4.5–6.0 mm long, limb 1.8–3.0 mm long, lobes 0.5–1.8 mm long, 0.3–0.4 mm wide at base; staminodia sometimes present. Disk florets 10–12; corolla yellow, glabrous, tube ca. 3 mm long, throat narrowly campanulate, ca. 3 mm long, lobes ca. 1.8 mm long, ca. 0.7 mm wide at base; anther collar cylindrical, ca. 0.6 mm long, thecae ca. 1.4 mm long, apical appendage ca. 0.7 mm long and 0.3 mm wide; apex of style 3 times as long as wide to base of apical hairs. Achenes immature, ca. 2 mm long, glabrous; pappus ca. 7 mm long, in 2 crowded series, gradually broadened to tip. Pollen grains ca. 37 μm diam.

The type specimen is said to be from "vegetación de bosque andina y paramal con áreas de cultivo y potrero, especies de *Weinmannia, Clusia, Podocarpus, Diplostephium, Hesperomeles, Clethra.*"

Gynoxys jaramilloi superficially resembles some of the more common members of the genus in southern Ecuador, such as *Gynoxys cuicochensis* Cuatrec., but the relationship is evidently not close. The type specimen was first noticed because of the seemingly rayless heads, some of which are mature enough to show rays if they were of normal size. A few female florets prove to be present, but they are small and often radially symmetrical with five lobes. The one female floret mounted on a microscope slide had a small raylike limb and small staminodia.

A more interesting distinction of the new species is in the hairs of the stems and leaves. The stem hairs are coarse and contorted, and they do not completely hide the surface of the stem. Similar unbranched, contorted, but smaller hairs are found in the denser pubescence on the leaf undersurface, but those surfaces have a dense underlayer of much smaller, contorted, T-shaped hairs. Such hairs have not been noticed in other species of *Gynoxys*, and most species obviously have hairs completely covering the young stems. Most species of *Gynoxys* have not had the hair types of their abaxial leaf surfaces examined in such detail, but unbranched and T-shaped hairs of similar size to each other are intermixed in *G. chingualensis* described above.

Paragynoxys regis (H. Robins. & Cuatrec.) H. Robinson & J. Cuatrecasas, comb. nov. Basionym: *Gynoxys regis* H. Robins. & Cuatrec., Phytologia 56: 370. 1984.

This species is unlike most *Gynoxys*, and like *Paragynoxys* in the lack of rays in the heads, the blunt tips of the style branches, and the long corolla lobes separated to the base of the throat. The species is unusual in *Paragynoxys* by the opposite leaves and the involucre of 5–8 bracts. Its closest relationship seems to be with the similarly small-leaved, Peruvian *Gynoxys lopezii* Dillon & Sagástegui (1988), which was transferred to *Paragynoxys* by Cuatrecasas (1990: 314).

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A New Species of *Petrea* (Verbenaceae) from Brazilian Amazonia

Ricardo M. Rueda

Departamento de Biología, Universidad Nacional Autónoma de Nicaragua, León, Nicaragua; present address: Missouri Botanical Garden, P.O. Box 299, St. Louis, Missouri 63166, U.S.A.

ABSTRACT. During preparation of a revision of the genus *Petrea* (Verbenaceae), it has become evident that six specimens from white sands in Roraima, Brazil, represent a new species that is herein described and given the name *Petrea campinae*. The new species is most closely related to *Petrea brevicalyx* from the same area.

Petrea campinae Rueda, sp. nov. TYPE: Brazil. Roraima: along the road from Manaus to Caracaraí, km 350, left side, 00°06′N, 60°40′W, 12 Feb. 1979 (fl), *W. Rodrigues, et al. 10100* (holotype, MG; isotypes, COL, INPA). Figure 1.

Frutex 1.5–5 m altus, ramulis puberulis. Folia breviter petiolata, laminis subtus foveatis, ellipticis, 5–10 cm longis, 1.5–6 cm latis, coriaceis, asperatis, apiculatis, venis secundariis 6–10. Inflorescentiae 10–22 cm longae, 2–5 cm latae; bracteis 2–4 mm longis, pedicellis 6–10 mm longis. Flos lobis calycinis 4–8 mm longis rotundatis, corolla hypocrateriformi, azurea, puberulo-glandulosa, 1.2–1.5 cm longa, lobis 3–6 mm longis, inaequalibus.

Shrub 1.5–5 m tall; branches tetragonal or subterete, minutely pubescent, pith well developed. Leaves decussate; petiole 3–8 mm long; blade elliptic, apiculate or truncate at apex, obtuse at base, 5–10 cm long, 1.5–6 cm wide, coriaceous, asperous, glabrous above, intricately pitted beneath with abundant short hairs in the pits, the midrib elevated above, prominently elevated beneath, the secondary veins brochidodromous, 6–10 on each side forming an angle of 60° with the midrib, impressed above, elevated beneath, ascending, with strongly defined veinlets delimiting the pits, the margins entire to slightly undulate. Inflorescences racemiform, axillary or terminal, many-flowered, 10–22 cm long, 2–5 cm wide; bracts setaceous to foliaceous, 2–4 mm long; pedicels 6–10 mm long; rachis, bracts, and pedicels minutely pubescent. Flowers with calyx glabrous, the lobes 5, unequal, rounded, 4–8 mm long; calicinal crest 5-cleft; corolla hypocrateriform, straight or curved, blue, glandular-pubescent, 1.2–1.5 cm long, the limb lobed, 5–8 mm wide, the lobes 5, ovate, 3–6 mm long, unequal; stamens 4, attached to corolla throat, the filaments stout, about 1.5 mm long, the anthers oblong; ovary globose, the style included, 2–3 mm long, the stigma capitate; basal disk about 1 mm long. Fruit not seen.

Paratypes. BRAZIL. RORAIMA: along BR 174 between Manaus and Caracaraí, 6 km S of equator, in a campina, 00°04′S, 60°40′W, 17 June 1985 (fl), *Cordeiro et al. 76* (INPA, SP); Road Manaus–Caracaraí, between km 345 and 360, in a campina, 15 Mar. 1984 (fl), *J. L. dos Santos, & Coelho 690* (INPA).

The *Cordeiro et al. 76* collection is from a shrub 5 m tall and is anomalous in having one pair of blades fused on a single petiole. This same specimen also has very anomalous flowers. Some of the flowers have 7 sepals and petals and a 7-parted calicinal crest; there is also a fifth stamen with deformed anthers. This is the only known case in *Petrea* L. where the calyx and corolla are not strictly 5-merous.

Petrea campinae resembles *P. brevicalyx* Ducke in having leaves elliptic, intricately pitted beneath, and calyx with short rounded lobes; it differs by having unequal calyx lobes, twice as long as those of the latter species, and it is erect, whereas *P. brevicalyx* is a liana.

All the collections of *P. campinae* come from sandy campinas in Roraima, from which vegetation formation the specific epithet is derived. Endemism in these white sand areas is common, as Prance (1982) noted for several species of Chrysobalanaceae. Another typical campina phenomenon illustrated by this new species is a shrubby habit in a taxon whose related forest species are lianas. This also occurs, for example, in the Bignoniaceae in the same area in the cases of *Distictella monophylla* Sandw. and *D. laevis* (Sandw.) A. Gentry (Gentry, pers. comm.).

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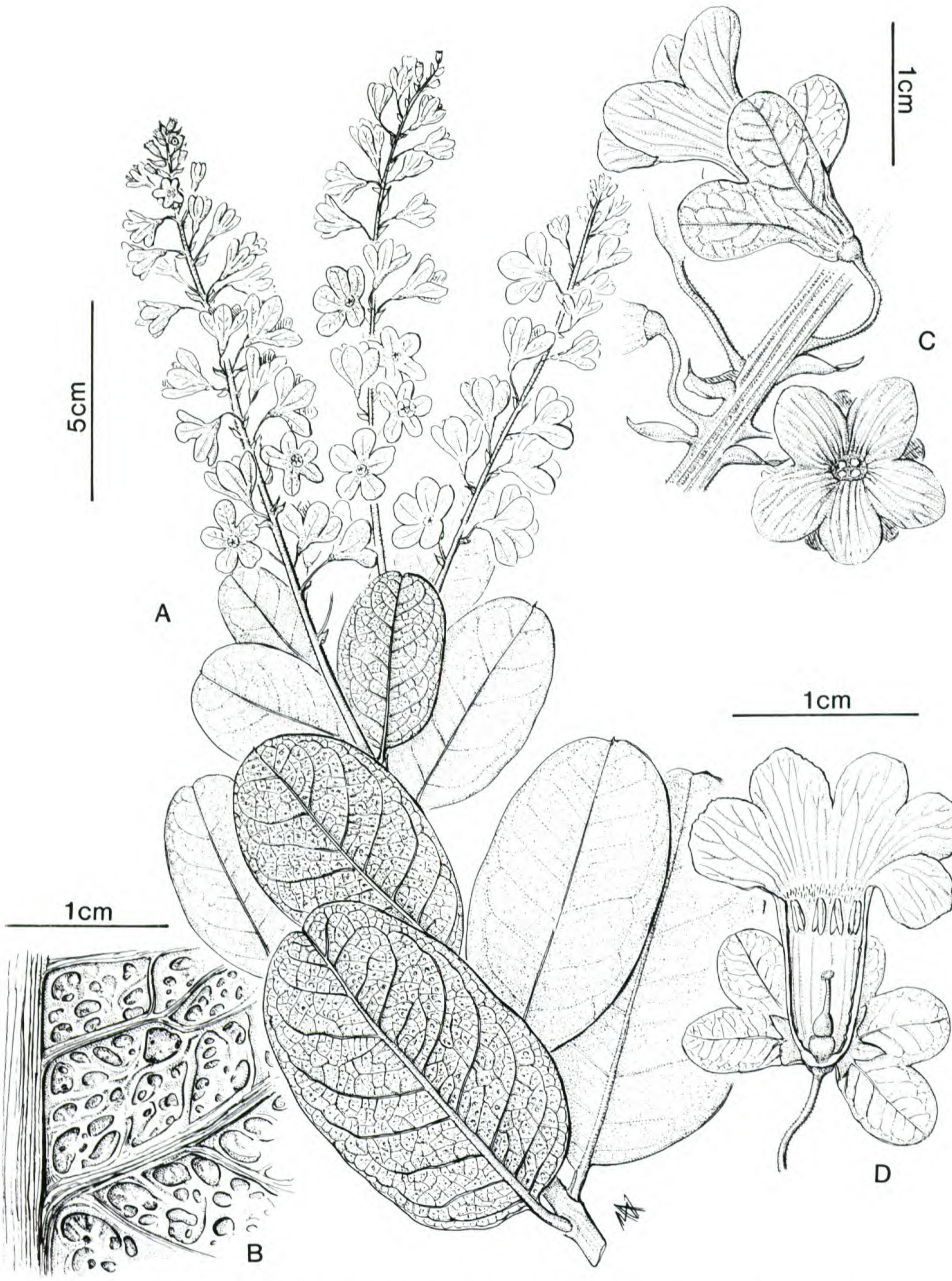

Figure 1. *Petrea campinae* Rueda (*W. Rodrigues et al. 10100*). —A. Habit. —B. Close up of abaxial leaf surface, showing pits. —C. Flower. —D. Flower, cut longitudinally and laid open.

A Review of the Fern Genus *Micropolypodium* (Grammitidaceae)

Alan R. Smith
University Herbarium, University of California, Berkeley, California 94720, U.S.A.

ABSTRACT. *Micropolypodium* differs from other genera of Grammitidaceae in having segments or pinnae each with a single unbranched or 1-forked vein, erect rhizomes, linear fronds generally less than 1 cm wide, unisoriate segments, and prominent hydathodes. About 30 species are known, most in tropical America and a few in eastern Asia. New combinations are made for the known species. A list of excluded names in *Xiphopteris*, in which most of the species have previously been placed, is provided.

Recent studies of grammitid ferns (Bishop, 1988, 1989; Smith et al., 1991; Smith & Moran, 1992; Parris, 1984, 1990) allude to the patent unnaturalness of traditional classifications of the Grammitidaceae, which have been based in large part on blade dissection. In an effort to arrive at a more natural classification of the family, studies initiated by Bishop and continued by Smith reveal that the genus *Micropolypodium*, established for a few Asian species, should be expanded to include many tropical American species heretofore placed variously in *Grammitis* (Morton, 1967), *Xiphopteris* (Copeland, 1952), and formerly *Polypodium* (Maxon, 1916). In lieu of a monographic treatment, which is needed especially for the South American species, and so that combinations are available for the forthcoming *Flora Mesoamericana*, I here provide a conspectus of *Micropolypodium* and make transfers of those species generally accepted in modern floristic accounts for Latin America (Proctor, 1977, 1985, 1989; Mickel & Beitel, 1988; Lellinger, 1989; Smith, 1981; Stolze, 1981). Following the transfers to *Micropolypodium*, I list all species that have been included within *Xiphopteris* and give their current taxonomic disposition, if known.

Micropolypodium Hayata, Bot. Mag. Tokyo 42: 341. 1928. TYPE: *Micropolypodium pseudotrichomanoides* (Hayata) Hayata, based on *Polypodium pseudotrichomanoides* Hayata [= *M. okuboi* (Yatabe) Hayata]. Figure 1A.

Plants usually epiphytic, rarely on rocks; rhizome radially symmetrical, suberect or erect, bearing golden, orangish, or yellow- to orange-brown, often lustrous, nonclathrate or weakly clathrate scales that are entire, irregularly toothed, sparsely glandular, or setulose on the margin, setulae concolorous or often darker than scale body, cells of body often tumid; fronds monomorphic or nearly so, short-stipitate, with petioles 0.2–0.5 mm diam., not articulate to the rhizome; lamina linear, commonly 3–15(–25) cm long, usually less than 1(–1.2) cm wide, shallowly to usually deeply pinnatifid, pinnatisect, or barely pinnate, with usually numerous oblong to deltate, decurrent segments (pinnae), these sometimes with an acroscopic hump (segments gibbous); segments planar, basiscopic side not folded over sorus; laminar tissue chartaceous to subcoriaceous; veins simple or with only an acroscopic fertile vein branch, lacking a dark sclerenchymatous sheath except at the very base of the segment (not extending more than $\frac{1}{10}$ the segment length); hydathodes present, round to clavate, usually conspicuous adaxially; setae often present on axes and lamina, these maroon to red-brown; hairs simple or often branched, mostly 0.1–0.5 mm long, multicellular with many short cells, at times glandular, hyaline with darkened cross-walls; sori round, superficial, one per pinna, usually adjacent to midrib at base of costa or on the acroscopic veinlet, borne along most of the blade length; paraphyses absent; sporangia glabrous.

The genus comprises about 30 species from southern Mexico to Bolivia and southern Brazil, and the Antilles; a few species occur in eastern Asia and Malesia (Japan, China, Sikkim, Philippines, New Guinea).

Micropolypodium differs from all other neotropical genera of Grammitidaceae by having segments (pinnae) with a single unbranched vein or with only an acroscopic branch (Figs. 1, 2A) and the segments often gibbous. Additional important (but not unique) characteristics are the radially symmetric erect rhizomes (Hayata 1928a, b, 1929), the often golden brown nonclathrate rhizome scales, linear fronds usually less than 10 mm wide and often less than 6 mm wide, unisoriate segments (pinnae), prominent adaxial hydathodes (Figs. 1D, G, H, 2A), and the long, dark red-brown unbranched setae. The type is from eastern Asia, but by far the greatest diversity in the genus is in the Neotropics, with species most numerous and diverse in the West Indies and Central America.

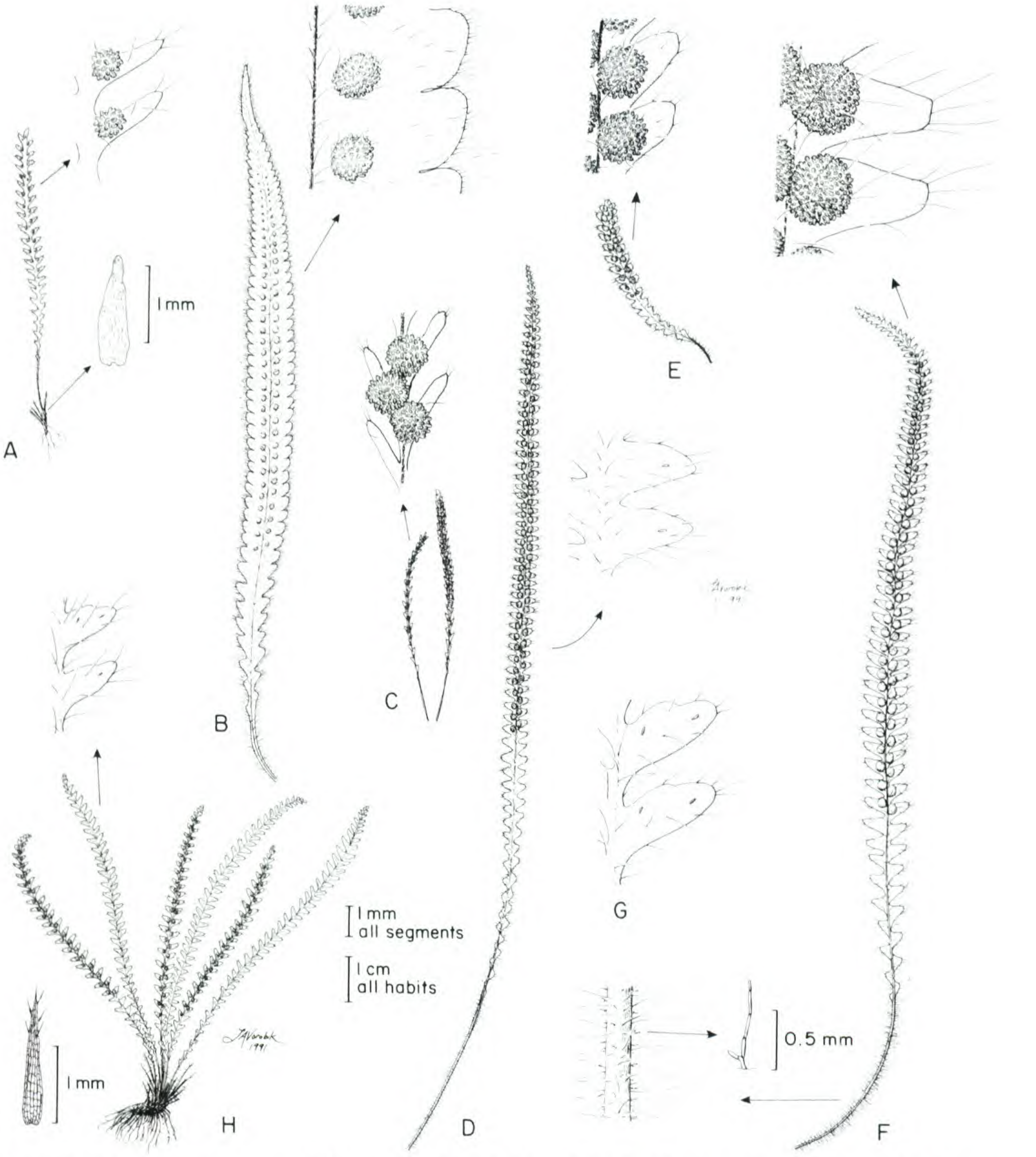

Figure 1. Representative species of *Micropolypodium*, habits and details of laminae, rhizome scales, and indument. —A. *M. okuboi* (*Tagawa 8303*, UC). —B. *M. truncicola* (*Silverstone-Sopkin et al. 3605*, UC). —C. *M. setosum* (*Hatschbach 44998*, UC). —D. *M. caucanum*, (*Liesner 24841*, UC). —E. *M. setulosum* (*Stork 2336*, UC). —F. *M. hyalinum* (*Smith & Béliz 2081*, UC). —G. *M. trichomanoides* (*Williams et al. 41935*, UC). —H. *M. nanum* (*Moore et al. 9673*, UC).

Thus defined, *Micropolypodium* seems homogeneous, without any readily apparent subgroups. I see no close affinities to any other neotropical or African genera of Grammitidaceae. The relationship of *Micropolypodium* to paleotropical genera, currently under study by Barbara Parris, is not apparent either. In the Old World, *Micropolypodium* may be most similar to *Calymmodon*, a genus of about 25 mostly Malesian species but extending from Sri Lanka to Tahiti. *Calymmodon* agrees with *Micropolypodium* in having ascending, radially symmetric rhizomes, often golden brown rhizome scales, usually narrow laminae, nonarticulate stipes, absence of paraphyses, unbranched veins, adaxial hy-

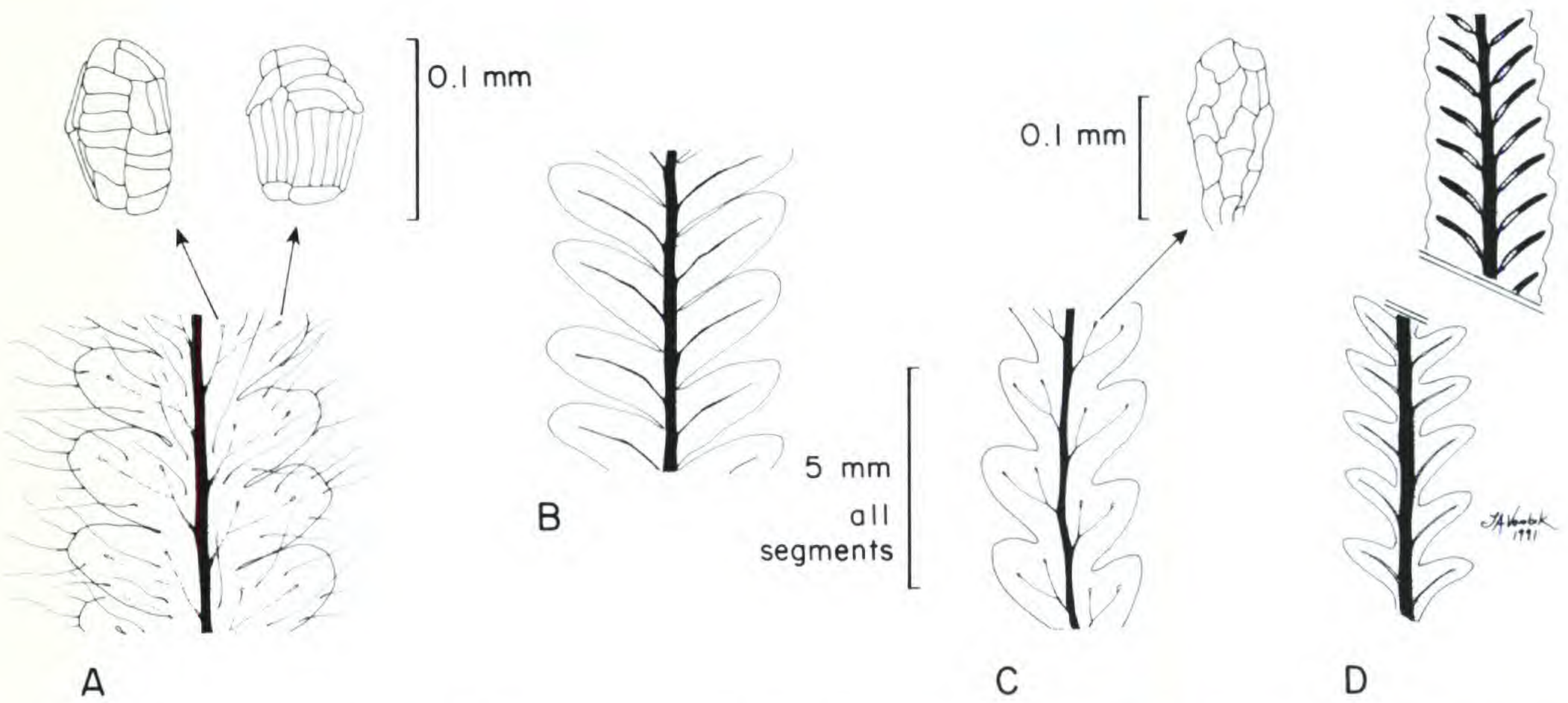

Figure 2. *Micropolypodium* and *Lellingeria* spp., details of venation and hydathodes. —A. *M. basiattenuata*, cleared lamina with details showing cellular pattern of hydathodes (*Underwood 1452*, US). —B. *Lellingeria hartii* (Jenman) A. R. Smith & R. C. Moran, cleared lamina (*Stehlé 1473*, US). —C. *Lellingeria schenckii* (Hieron.) A. R. Smith & R. C. Moran, cleared lamina with detail showing cellular pattern of hydathodes (*Brade 6583*, US). —D. *Lellingeria myosuroides* (Sw.) A. R. Smith & R. C. Moran, cleared lamina (*Proctor 4363*, US).

dathodes, and a single sorus per segment or pinna. *Calymmodon* differs in the usually whitish to pale red-brown setae on the axes and blades, often winged stipes, 1–5-branched hyaline hairs lacking darkened cross-walls on the hair branches, scales with 1(–2) hyaline seta(e) at the tip, sori often confined to the distal part of frond, thinner laminar tissue, and fertile segments with basiscopic side folded upwards to form a pouch for the sorus (see Parris, 1990, tab. 4000).

The similarities between species of *Micropolypodium* and some species of *Lellingeria* (Smith et al., 1991), particularly the *L. limula/myosuroides* group, in blade size and dissection are obvious, but the striking differences in rhizome scales indicate that the relationship is not a close one. These scale differences were noted many years ago by Maxon (1916: 542), who divided plants of this general form into two groups, based upon the differences in rhizome scales. Scales of *Micropolypodium* are usually golden to golden brown and concolorous; occasionally the lateral walls are slightly darker than the surface walls, and the scales might be described as subclathrate. However, they are never strongly clathrate to the degree found in *Lellingeria limula* or *Melpomene moniliformis* and their allies. Scale differences in Grammitidaceae have frequently been noted and used in descriptions and keys, but their significance in distinguishing large groups of species has not been realized until recently.

Another difference between the two genera is in the setae on the stipe and rachis, which are dark red-brown and simple in *Micropolypodium* but usually whitish or hyaline, often branched, and generally much shorter in *Lellingeria*. Narrow-bladed species of *Lellingeria* (*L. myosuroides* group) usually have dark sclerenchymatous tissue covering the veins (Fig. 2B–D). These red-brown cells extend most of the length of the vein to the hydathode and are best seen in cleared fronds. Species of *Micropolypodium* generally lack darkened costae, or the sclerenchyma of the rachis extends less than 0.5 mm as rudimentary branches at the base of the segments (Fig. 2A).

Hydathodes in most species of *Micropolypodium* are among the most prominent of any genus in the family. The cell pattern on the surface of the hydathodes, as seen in cleared fronds, is strikingly dissimlar to the epidermal cell pattern, with many cells rather elongate (Fig. 2A). Although this character has not yet been studied in detail, most other hydathodous grammitid genera (e.g., *Lellingeria*) appear to have the cells of the hydathode more nearly isodiametric, smaller, and less obviously different from epidermal cells (Fig. 2C).

The setae in *Micropolypodium* also appear to differ from those of many other grammitid genera. A ring of cells, different from the surrounding epidermal cells, radiates from the base of the seta in *M. basiattenuata* and in several other species of *Micropolypodium* examined. This specialized cell pattern at the base of the setae has not been detected in preliminary surveys of other grammitid genera.

Only a few chromosome counts have been reported for species belonging to *Micropolypodium*. Walker (1985) counted $2n = 74$ for *M. taenifolium* (as *Grammitis taenifolia*) from Trinidad. Silva Ar-

aujo (1976) reported $2n$ = ca. 36 for *M. trichomanoides* (as *Grammitis trichomanoides*) from near Manaus, Brazil. The voucher (not seen) is probably misidentified and from the locality may be *M. nanum*, which is the only species of *Micropolypodium* known from near Manaus. A base number of x = 37 is known in most other genera of Grammitidaceae, e.g., *Enterosora*, *Ceradenia*, and *Melpomene*. In *Lellingeria*, base numbers of x = 32 and 33 are so far known (see Smith et al., 1991), and these numbers suggest an additional difference between *Micropolypodium* and *Lellingeria*.

AMERICAN SPECIES

Micropolypodium aphelolepis (C. Morton) A. R. Smith, comb. nov. Basionym: *Grammitis aphelolepis* C. Morton, Contr. U.S. Natl. Herb. 38: 97. 1967. *Xiphopteris aphelolepis* (C. Morton) Pichi-Serm. Distribution: Ecuador.

Micropolypodium basiattenuatum (Jenman) A. R. Smith, comb. nov. Basionym: *Polypodium basiattenuatum* Jenman, Bull. Bot. Dept. Jamaica, n.s. 4: 114. 1897. *Grammitis basiattenuata* (Jenman) Proctor. *Xiphopteris basiattenuata* (Jenman) Copel. Distribution: Jamaica, southern Mexico, Guatemala, Honduras.

Micropolypodium blepharideum (Copel.) A. R. Smith, comb. nov. Basionym: *Polypodium blepharideum* Copel., Univ. Calif. Publ. Bot. 19: 304, pl. 64. 1941. *Xiphopteris blepharidea* (Copel.) Copel. Distribution: Peru.

Micropolypodium caucanum (Hieron.) A. R. Smith, comb. nov. Basionym: *Polypodium caucanum* Hieron., Bot. Jahrb. Syst. 34: 503. 1904. *Grammitis caucana* (Hieron.) C. Morton. *Xiphopteris caucana* (Hieron.) Copel. Distribution: Costa Rica to Ecuador and Venezuela. Figure 1D.

Micropolypodium cookii (L. Underw. & Maxon) A. R. Smith, comb. nov. Basionym: *Polypodium cookii* L. Underw. & Maxon, Contr. U.S. Natl. Herb. 17: 408. 1914. *Grammitis cookii* (L. Underw. & Maxon) F. Seymour. *Xiphopteris cookii* (L. Underw. & Maxon) Copel. Distribution: Guatemala to Costa Rica.

Micropolypodium grisebachii (L. Underw. ex C. Chr.) A. R. Smith, comb. nov. Basionym: *Polypodium grisebachii* L. Underw. ex C. Chr., Index Filic. 531. 1906, based on *Polypodium exiguum* Griseb., Fl. Br. W. Ind. 701. 1864, non Heward, 1838. *Grammitis grisebachii* (L. Underw. ex C. Chr.) Proctor. *Xiphopteris grisebachii* (L. Underw. ex C. Chr.) Copel. Distribution: Jamaica, Lesser Antilles.

Micropolypodium hyalinum (Maxon) A. R. Smith, comb. nov. Basionym: *Polypodium hyalinum* Maxon, Contr. U.S. Natl. Herb. 17: 406. 1913. *Grammitis hyalina* (Maxon) F. Seymour. *Xiphopteris hyalina* (Maxon) Copel. Distribution: Costa Rica, Panama, Ecuador. Figure 1F.

Micropolypodium knowltoniorum (Hodge) A. R. Smith, comb. nov. Basionym: *Polypodium knowltoniorum* Hodge, Amer. Fern J. 31: 105, t. 1, figs. 4–6. 1941. *Grammitis knowltoniorum* (Hodge) Proctor. *Xiphopteris knowltoniorum* (Hodge) Copel. Distribution: Lesser Antilles.

Micropolypodium liesneri (A. R. Smith) A. R. Smith, comb. nov. Basionym: *Grammitis liesneri* A. R. Smith, Ann. Missouri Bot. Gard. 77: 257. 1990. Distribution: eastern Venezuela.

Micropolypodium nanum (Fée) A. R. Smith, comb. nov. Basionym: *Polypodium nanum* Fée, Gen. Filic. 238. 1852. *Grammitis blanchetii* (C. Chr.) A. R. Smith. *Polypodium blanchetii* C. Chr. *Xiphopteris nana* (Fée) Copel. Distribution: Venezuela, Guianas, Colombia, Amazonian Brazil. Figure 1H.

Micropolypodium nimbatum (Jenman) A. R. Smith, comb. nov. Basionym: *Polypodium nimbatum* Jenman, J. Bot. 24: 271. 1886. *Grammitis nimbata* (Jenman) Proctor. *Xiphopteris nimbata* (Jenman) Copel. Distribution: Cuba, Jamaica, Hispaniola; U.S.A. (disjunct in Macon Co., North Carolina).

Micropolypodium perpusillum (Maxon) A. R. Smith, comb. nov. Basionym: *Polypodium perpusillum* Maxon, Contr. U.S. Natl. Herb. 17: 409. 1913. *Xiphopteris perpusilla* (Maxon) Copel. Distribution: Brazil (Minas Gerais).

Micropolypodium plicatum (A. R. Smith) A. R. Smith, comb. nov. Basionym: *Grammitis plicata* A. R. Smith, Ann. Missouri Bot. Gard. 77: 258. 1990. Distribution: eastern Venezuela.

Micropolypodium pulogense (Copel.) A. R. Smith, comb. nov. Basionym: *Polypodium pulogense* Copel., Philipp. J. Sci. 6: 148. 1911. *Xiphopteris pulogensis* (Copel.) Copel. Distribution: Philippines.

Micropolypodium serricula (Fée) A. R. Smith, comb. nov. Basionym: *Polypodium serricula* Fée, Gen. Fil. 238. 1852. *Grammitis serricula* (Fée) Proctor. *Xiphopteris serricula* (Fée) Copel. Distribution: Lesser Antilles.

Micropolypodium setosum (Kaulf.) A. R. Smith, comb. nov. Basionym: *Xiphopteris setosa* Kaulf., Enum. Filic. 275. 1824. *Grammitis setosa* (Kaulf.) C. Presl, non Blume, 1828.

Polypodium micropteris C. Chr. Distribution: southern Brazil. Figure 1C.

Micropolypodium setulosum (Rosenstock) A. R. Smith, comb. nov. Basionym: *Polypodium setulosum* Rosenstock, Repert. Sp. Nov. Regni Veg. 10: 277. 1912. *Grammitis setulosa* (Rosenstock) F. Seymour. *Xiphopteris setulosa* (Rosenstock) Copel. Distribution: Costa Rica, Panama. Figure 1E.

Micropolypodium sherringii (Baker) A. R. Smith, comb. nov. Basionym: *Polypodium sherringii* Baker in Jenman, J. Bot. 20: 26. 1882. *Grammitis sherringii* (Baker) Proctor. *Xiphopteris sherringii* (Baker) Copel. Distribution: Cuba, Jamaica.

Micropolypodium taenifolium (Jenman) A. R. Smith, comb. nov. Basionym: *Polypodium taenifolium* Jenman, Bull. Bot. Dept. Jamaica, n.s. 4: 114. 1897. *Grammitis blepharodes* (Maxon) F. Seymour. *Grammitis taenifolia* (Jenman) Proctor. *Polypodium blepharodes* Maxon. *Xiphopteris blepharodes* (Maxon) Copel. *Xiphopteris taenifolia* (Jenman) Copel. Distribution: Antilles, northern South America.

Micropolypodium trichomanoides (Sw.) A. R. Smith, comb. nov. Basionym: *Polypodium trichomanoides* Sw., Prodr. 131. 1788. *Grammitis trichomanoides* (Sw.) Ching. *Xiphopteris trichomanoides* (Sw.) Copel. Distribution: Cuba, Jamaica, southern Mexico, Guatemala, Venezuela. Figure 1G.

Micropolypodium truncicola (Klotzsch) A. R. Smith, comb. nov. Basionym: *Polypodium truncicola* Klotzsch, Linnaea 20: 374. 1847. *Grammitis truncicola* (Klotzsch) C. Morton. *Polypodium andinum* Hook. *Xiphopteris truncicola* (Klotzsch) Copel. Distribution: Costa Rica to Venezuela and Peru. Figure 1B.

Micropolypodium williamsii (Maxon) A. R. Smith, comb. nov. Basionym: *Polypodium williamsii* Maxon, Contr. U.S. Natl. Herb. 17: 547, pl. 34. 1916. *Grammitis williamsii* (Maxon) Lellinger. *Xiphopteris williamsii* (Maxon) Copel. Distribution: Bolivia.

Micropolypodium zurquinum (Copel.) A. R. Smith, comb. nov. Basionym: *Xiphopteris zurquina* Copel., Amer. Fern J. 42: 99. 1952. *Grammitis zurquina* (Copel.) F. Seymour. Distribution: Costa Rica.

The following names (listed alphabetically by basionym) clearly apply to species of *Micropolypodium*, but until monographic or floristic work can be undertaken in their area of occurrence, their status (whether synonyms or good species) is unclear. They are not likely to supersede any of the combinations made above.

Polypodium basale Maxon, Amer. Fern J. 52: 110. 1962. *Grammitis basalis* (Maxon) Lellinger. Distribution: Ecuador. This species was omitted by Morton (1967).

Polypodium blepharolepis C. Chr., Index Fil. Suppl. 1: 58. 1913. *Grammitis blepharolepis* (C. Chr.) C. Morton. *Xiphopteris blepharolepis* (C. Chr.) Copel. Distribution: Ecuador, Peru.

Polypodium buesii Maxon, Contr. Gray Herb. 165: 72. 1947. *Grammitis buesii* (Maxon) Lellinger. *Xiphopteris buesii* (Maxon) Copel. Distribution: Peru.

Polypodium daguense Hieron., Bot. Jahrb. Syst. 34: 504. 1904. *Grammitis daguensis* (Hieron.) C. Morton. *Xiphopteris daguensis* (Hieron.) Copel. Distribution: Colombia.

Polypodium gibbosum Fée, Mém. Foug. 6: 8, pl. 2, f. 2. 1854. This species was said by Fée to be from Mexico, probably erroneously.

Polypodium gracillimum Hieron., Hedwigia 48: 250. 1909, non Copel., 1905. = *P. blepharolepis* C. Chr.

Polypodium pseudotrichomanoides Hayata, Icon. Fl. Formosa 4: 251, f. 176. 1914. *Micropolypodium pseudotrichomanoides* (Hayata) Hayata, Bot. Mag. (Tokyo) 42: 341. 1928. Distribution: Taiwan. This species is probably conspecific with *Micropolypodium okuboi*.

Polypodium pullei Alston, J. Bot. 78: 229. 1940. Distribution: New Guinea. This is possibly a synonym of *Micropolypodium pulogense* (Parris, in litt.).

Polypodium sikkimense Hieron., Hedwigia 44: 97. 1905. *Xiphopteris sikkimensis* (Hieron.) Copel. Distribution: Sikkim.

Xiphopteris killipii Copel., Amer. Fern J. 42: 105. 1952. *Grammitis killipii* (Copel.) Lellinger. Distribution: Colombia.

Excluded New World Species

The following New World species of *Xiphopteris* (or *Grammitis*) historically have been thought to be closely allied by Copeland (1952) and others with species here included in *Micropolypodium*. Their combinations in *Xiphopteris* (or *Grammitis*, if no combination has been made in *Xiphopteris*), together with their taxonomic disposition, are given in alphabetical order:

Grammitis anamorphosa Proctor ≡ *Lellingeria anamorphosa* (Proctor) A. R. Smith & R. C. Moran

Grammitis nutata (Jenman) Proctor ≡ *Lellingeria nutata* (Jenman) A. R. Smith & R. C. Moran

Grammitis pseudomitchellae Lellinger ≡ *Lellingeria pseudomitchellae* (Lellinger) A. R. Smith & R. C. Moran

Grammitis ruglessii Proctor ≡ *Lellingeria ruglessii* (Proctor) A. R. Smith & R. C. Moran

Xiphopteris allosuroides (Rosenstock) Crabbe ≡ *Melpomene allosuroides* (Rosenstock) A. R. Smith & R. C. Moran

Xiphopteris amphidasyon (Kunze ex Mett.) Alston = "*Terpsichore*"

Xiphopteris apiculata (Kunze ex Klotzsch) Copel. ≡ *Lellingeria apiculata* (Kunze ex Klotzsch) A. R. Smith & R. C. Moran

Xiphopteris aromatica (Maxon) Crabbe ≡ *Melpomene firma* (J. Smith) A. R. Smith & R. C. Moran

Xiphopteris auyantepuiensis Vareschi ≡ *Cochlidium serrulatum* (Sw.) L. E. Bishop

Xiphopteris capillaris (Desv.) Crabbe ≡ *Ceradenia capillaris* (Desv.) L. E. Bishop

Xiphopteris choquetangensis (Rosenstock) Crabbe ≡ *Pecluma choquetangensis* (Rosenstock) M. G. Price

Xiphopteris cultrata (Bory ex Willd.) Schelpe ≡ "*Terpsichore*"

Xiphopteris delitescens (Maxon) Copel. ≡ *Lellingeria delitescens* (Maxon) A. R. Smith & R. C. Moran

Xiphopteris extensa Fée = *Cochlidium serrulatum* (Sw.) L. E. Bishop

Xiphopteris flabelliformis (Poiret) Schelpe ≡ *Melpomene flabelliformis* (Poiret) A. R. Smith & R. C. Moran

Xiphopteris hartii (Jenman) Copel. ≡ *Lellingeria hartii* (Jenman) A. R. Smith & R. C. Moran

Xiphopteris heteromorpha (Hook. & Grev.) Crabbe ≡ "*Terpsichore*"

Xiphopteris jamesonii Hook. ≡ *Lellingeria myosuroides* (Sw.) A. R. Smith & R. C. Moran

Xiphopteris lanigera (Desv.) Crabbe ≡ "*Terpsichore*"

Xiphopteris limula (Christ) Pichi-Serm. ≡ *Lellingeria limula* (Christ) A. R. Smith & R. C. Moran

Xiphopteris longa (C. Chr.) Alston = "*Terpsichore*"

Xiphopteris luetzelburgii (Rosenstock) Brade = *Lellingeria wittingiana* (Fée) A. R. Smith & R. C. Moran?

Xiphopteris mitchellae (Baker ex Hemsley) Copel. ≡ *Lellingeria mitchellae* (Baker ex Hemsl.) A. R. Smith & R. C. Moran

Xiphopteris moniliformis (Lagasca ex Sw.) Crabbe ≡ *Melpomene moniliformis* (Lagasca ex Sw.) A. R. Smith & R. C. Moran

Xiphopteris mortonii Copel., Amer. Fern J. 42: 97. 1952. ≡ *Lellingeria*

Xiphopteris myosuroides (Sw.) Kaulf. ≡ *Lellingeria myosuroides* (Sw.) A. R. Smith & R. C. Moran

Xiphopteris myriophylla (Mett.) Crabbe = "*Terpsichore*"

Xiphopteris organensis (Gardner) Copel. ≡ *Lellingeria organensis* (Gardner) A. R. Smith & R. C. Moran

Xiphopteris peruviana (Desv.) Crabbe ≡ *Melpomene peruviana* (Desv.) A. R. Smith & R. C. Moran

Xiphopteris pilosissima (M. Martens & Galeotti) Crabbe ≡ *Melpomene pilosissima* (M. Martens & Galeotti) A. R. Smith & R. C. Moran

Xiphopteris pozuzoënsis (Baker) Crabbe = *Ceradenia pilipes* (Hook.) L. E. Bishop

Xiphopteris reitzii Alston ≡ *Lellingeria*

Xiphopteris schenckii (Hieron.) Copel. ≡ *Lellingeria schenckii* (Hieron.) A. R. Smith & R. C. Moran

Xiphopteris serrulata (Sw.) Kaulf. ≡ *Cochlidium serrulatum* (Sw.) L. E. Bishop

Xiphopteris shaferi (Maxon) Kramer ≡ *Lellingeria shaferi* (Maxon) A. R. Smith & R. C. Moran

Xiphopteris skutchii (Maxon) Copel. = *Lellingeria myosuroides* (Sw.) A. R. Smith & R. C. Moran

Xiphopteris sodiroi (Christ & Rosenstock) Crabbe ≡ *Melpomene sodiroi* (Christ & Rosenstock) A. R. Smith & R. C. Moran

Xiphopteris strictissima (Hook.) Vareschi = *Lellingeria myosuroides* (Sw.) A. R. Smith & L. E. Bishop

Xiphopteris subscabra (Klotzsch) Crabbe ≡ *Polypodium subscabrum* Klotzsch (see Stolze, 1991)

Xiphopteris wittingiana (Fée) Brade ≡ *Lellingeria wittingiana* (Fée) A. R. Smith & R. C. Moran

Xiphopteris yungensis (Rosenstock) Crabbe = "*Terpsichore*"

Excluded Old World species of *Xiphopteris*

Xiphopteris aethiopica Pichi-Serm. ≡ *Lellingeria aethiopica* (Pichi-Serm.) A. R. Smith & R. C. Moran

Xiphopteris albobrunnea (Baker) Schelpe

Xiphopteris alternidens (Cesati) Copel. (see Parris, 1986)

Xiphopteris antipodalis Copel.

Xiphopteris apoensis (Copel.) Copel.

Xiphopteris ascensionensis (Hieron.) Cronk = *Lellingeria*

Xiphopteris bryophylla (v.A.v.R.) Parris = *X. musgraviana* (see Parris, 1986)

Xiphopteris conjunctisora (Baker) Copel. = *Grammitis*? (see Parris, 1983)

Xiphopteris cornigera (Baker) Copel. (see Parris, 1986)

Xiphopteris cucullata (Nees & Blume) Sprengel ≡ *Calymmodon cucullatus* (Nees & Blume) C. Presl

Xiphopteris elastica (Bory ex Willd.) Alston = "*Terpsichore*"

Xiphopteris exilis Parris (see Parris, 1986)

Xiphopteris glandulosopilosa (Brause) Copel. = *X. musgraviana* (see Parris, 1986)

Xiphopteris govidjoaensis (Brause) Copel.

Xiphopteris hecistophylla (Copel.) Copel.

Xiphopteris heterophylla Sprengel ≡ *Grammitis*? (see Parris, 1984)

Xiphopteris hieronymusii (C. Chr.) Holttum. *Polypodium sertularioides* J. Smith ex Hieron. (non Baker, 1876). = *X. cornigera*

Xiphopteris hildebrandtii (Hieron.) Tard. ≡ *Lellingeria hildebrandtii* (Hieron.) A. R. Smith & R. C. Moran

Xiphopteris khaoluangensis Tag. & Iwatsuki = *X. cornigera*? (Parris, in litt.)

Xiphopteris murudensis (Copel.) Copel.

Xiphopteris musgraviana (Baker) Parris (see Parris, 1986)

Xiphopteris oosora (Baker) Alston ≡ *Lellingeria oosora* (Baker) A. R. Smith & R. C. Moran

Xiphopteris orientalis (Desv.) Fourn. = *Cochlidium serrulatum* (Sw.) L. E. Bishop

Xiphopteris punctata (Ballard) Alston = *Ceradenia pruinosa* (Maxon) L. E. Bishop

Xiphopteris rigescens (Bory ex Willd.) Alston = *Melpomene flabelliformis* (Poiret) A. R. Smith & R. C. Moran

Xiphopteris saffordii (Maxon) Copel. ≡ *Lellingeria saffordii* (Maxon) A. R. Smith & R. C. Moran

Xiphopteris setulifera (v.A.v.R.) Parris = *Polypodium pumilum* Brause (non Cockayne, 1909) (see Parris, 1986)

Xiphopteris sparsipilosa (Holttum) Holttum (see Parris, 1986)

Xiphopteris strangeana Pichi-Serm. ≡ *Lellingeria strangeana* (Pichi-Serm.) A. R. Smith & R. C. Moran

Xiphopteris subcoriacea (Copel.) Copel. ≡ *Lellingeria subcoriacea* (Copel.) A. R. Smith & R. C. Moran

Xiphopteris subpinnatifida (Blume) Copel. (see Parris, 1986)

Xiphopteris villosissima (Hook.) Alston ≡ *Zygophlebia villosissima* (Hook.) L. E. Bishop

Xiphopteris zenkeri (Hieron.) Schelpe ≡ *Ctenopteris zenkeri* (Hieron.) Tard.

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Melpomene, a New Genus of Grammitidaceae (Pteridophyta)

Alan R. Smith
University Herbarium, University of California, Berkeley, California 94720, U.S.A.

Robbin C. Moran
Missouri Botanical Garden, P.O. Box 299, St. Louis, Missouri 63166-0299, U.S.A.

ABSTRACT. *Melpomene*, a new genus of Grammitidaceae, is described, and combinations are made for the species known to belong to it. *Melpomene* can be distinguished from all other Grammitidaceae by its rhizome scales that are clathrate, basally cordate, and entire except at the apex where provided with one to ten minute papillae. The genus contains about 20 species and is primarily neotropical.

This paper is one in a series that have set forth new generic concepts in neotropical Grammitidaceae. In the series, *Grammitis* sensu lato has been divided into smaller monophyletic groups that have not previously been known or recognized. These groups, given generic status, are *Cochlidium* (Bishop, 1978), *Ceradenia* (Bishop, 1988), *Enterosora* (Bishop & Smith, 1992), *Grammitis* (Bishop, 1977), *Lellingeria* (Smith et al., 1991), and *Zygophlebia* (Bishop, 1989). Each group is believed to be monophyletic because it is defined by several correlating characteristics. In this paper, we describe another monophyletic group within the Grammitidaceae: *Melpomene* (the name of the Muse of Tragedy).

The distinctness of *Melpomene* was first recognized by the late L. Earl Bishop. We have determined what species belong to the genus and have found additional characteristics that define it. Therefore, we take sole reponsibility for the description of the genus and new combinations.

Melpomene A. R. Smith & R. C. Moran, gen. nov. TYPE: *Polypodium moniliforme* Lagasca ex Sw., Syn. Fil. 33. 1806. = *Melpomene moniliformis* (Lagasca ex Sw.) A. R. Smith & R. C. Moran. Figure 1.

Plantae epiphyticae terrestres vel rupestres; squamae rhizomatis clathratae denigratae brunneolae vel vulgo rubellae integrae, base cordatae, apice glandulis praeditae; phyllopodia absentia; folia plerumque pinnatisecta, hydathodis adaxialiter ornata; petioli et rhachides setosi, setis castaneis; venae non furcatae librae; sori rotundi superficiales.

Epiphytic, epipetric, or terrestrial; rhizome erect or short- to long-creeping, the scales strongly clathrate, cordate basally and attached at a single point, usually blackish or reddish, never setulose, with one to several papillose cells (glandular?) ca. 0.1 mm long at the apex, these often dislodged and not present; phyllopodia absent; leaves pinnatifid, pinnatisect, or rarely 1-pinnate basally, linear to elliptic, pubescent and often setose, the hairs 0.1–0.2 mm long, branched, 2–8-celled, lax, pale reddish, with most of the color concentrated at the cross walls, the setae 0.3–3 mm long, castaneous, multicellular (the cross walls sometimes difficult to observe), erect to spreading; hydathodes present; veins free, often not visible; sori round or (rarely) slightly oblong, discrete, superficial or rarely slightly sunken, lacking globose, waxlike paraphyses, but some species with castaneous receptacular setae.

In his revision of American grammitids (as *Ctenopteris*), Copeland (1955) treated the species of *Melpomene* in four of his ten species groups. He placed most of the species of *Melpomene*, however, under the group of *C. moniliformis* (Lagasca ex Sw.) J. Smith (the first of his ten groups). In this group he also included several species now placed in *Lellingeria* and a few species belonging to other genera. Copeland defined the *C. moniliformis* group very loosely, saying that it consisted of "small, linear, coriaceous ferns" that were related to *Ctenopteris moniliformis* (= *Melpomene moniliformis*). Obviously, Copeland's characterization of the group is not sufficient to establish monophyly. Yet *Melpomene* does appear to be monophyletic, and we have found several characteristics of the stem scales that define it.

All *Melpomene* species have scales that are clathrate throughout (Fig. 1B, D, I, J, L, M, S). The scales are entire except at or near the apex, where one to ten, minute glandular cells occur (Fig. 1I, J, O, P). The base of the scales is cordate, sometimes with the basal auricles overlapping, and attached at a point (Fig. 1B, D, I, L, O, R). These four characteristics of the scales distinguish *Melpomene* from all other genera in the family.

Lellingeria is the only other genus of neotropical

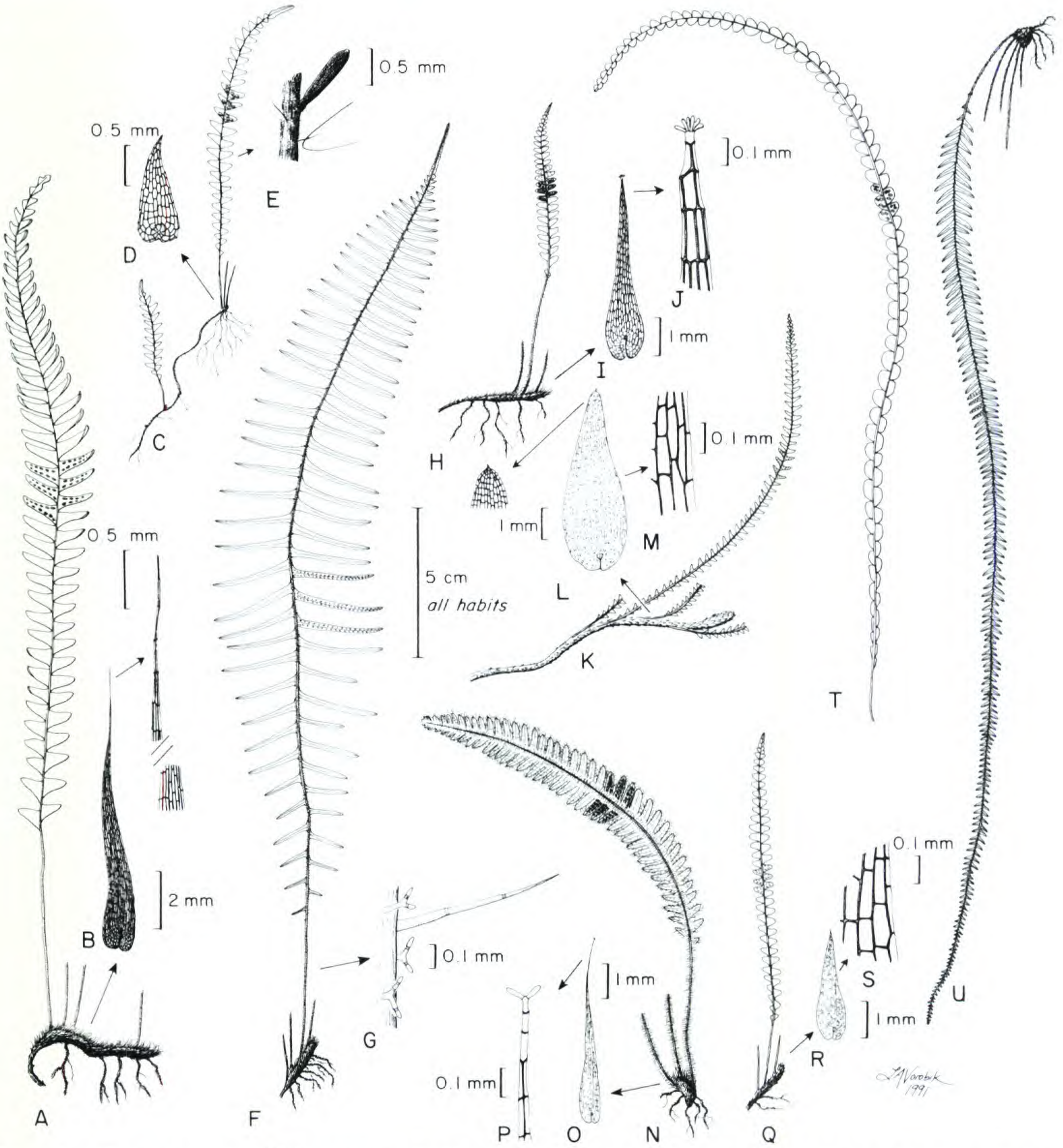

Figure 1. Characteristics of *Melpomene*. A, B. *M. sodiroi*, *Rimbach s.n.* (Rosenstock exsic. 13; UC). —A. Habit. —B. Rhizome scale. C–E. *M. anfractuosa*, *Mickel 6771* (UC). —C. Habit, with small leaf from root proliferations. —D. Rhizome scale. —E. Fungal fruiting body from rachis. F, G. *M. firma*, *van der Werff & Gudiño 11105* (UC). —F. Habit. —G. Hairs on petiole. H–J. *M. flabelliformis*, *Smith et al. 1478* (UC). —H. Habit. —I. Rhizome scale. —J. Tip of rhizome scale. K–M. *M. erecta*, *Steyermark et al. 100548* (UC). —K. Habit. —L. Rhizome scale. —M. Detail of rhizome scale. N–P. *M. pilosissima*, *Mickel & Hellwig 3775* (UC). —N. Habit. —O. Rhizome scale. —P. Tip of rhizome scale. Q–S. *M. moniliformis*, *Mickel & Hellwig 4041* (UC). —Q. Habit. —R. Rhizome scale. —S. Detail of rhizome scale. —T. *M. assurgens*, habit, *van der Werff & Palacios 8960* (UC). —U. *M. leptostoma*, habit, *Hutchison 440* (UC).

Grammitidaceae that has strongly clathrate stem scales. Its scales, however, are often setulose marginally and/or at the apex and lack glands (or papillae) near the apex (Smith et al., 1991). The scales are also truncate basally, being attached across the entire length of the base.

In addition to the stem scales, *Melpomene* has other characteristics that distinguish it, although these characteristics are not unique to the genus. In habit, the leaves are erect, never laxly pendent as in many American grammitids (the only exception is *M. leptostoma* (Fée) A. R. Smith & R. C. Moran, which may have arching or pendent leaves; Fig. 1U). The laminae are generally thick or coriaceous,

Figure 2. Worldwide distribution of *Melpomene*. The number on the left is the number of species in the region; the number in parentheses is the number of those species endemic to the region.

and linear to narrowly elliptic (but *M. firma* (J. Smith) A. R. Smith & R. C. Moran may have broadly elliptic laminae). Dark, castaneous setae are present in most species, especially along the rachis and around the sori. These dark, castaneous setae are usually absent along the segment margins, with the exception of *M. pilosissima* (M. Martens & Galeotti) A. R. Smith & R. C. Moran, which has setae along the margins throughout, and *M. anfractuosa* (Kunze ex Klotzsch) A. R. Smith & R. C. Moran, which has marginal setae near the segment apices. The sporangial capsules are glabrous (never setulose), and the receptacle lacks glands. All species have conspicuous hydathodes adaxially, which distinguishes the genus from the anhydathodous *Ceradenia*, *Zygophlebia*, and *Enterosora*. *Melpomene anfractuosa* is unusual in the genus in having plantlets produced from buds on the roots (Fig. 1C) and by bearing black club-shaped fruiting bodies of the ascomycete *Acrospermum maxonii* Farlow (Fig. 1E).

Many species of *Melpomene*, when dried, emit a sweet spicy fragrance that does not occur in other grammitid genera. The fragrance persists for many decades after the plants are dried. This aroma can be almost overpowering to some individuals, while scarcely noticeable by others. Proctor (1985) reported that specimens of *M. firma* were still fragrant after 100 years. Mickel & Beitel (1988: 199) reported a "decidedly sweet smell on drying" in members of the *M. moniliformis* group. The species that have this fragrance often discolor the herbarium sheet on which they are mounted, turning the paper brownish. The species that we have noted as having this fragrance include, but are not restricted to, *M. firma*, *M. flabelliformis*, *M. pilosissima*, *M. peruviana*, *M. vernicosa*, and *M. xiphopteroides*. Nothing is known about the chemistry of this fragrance.

Chromosome counts and spores, which are often helpful in defining fern genera, do not distinguish *Melpomene* from other genera of Grammitidaceae. Only one chromosome count is known in *Melpomene*: n = ca. 74 in *M. moniliformis* from Jamaica (Walker, 1966). This appears to be a tetraploid number based on 37, which is a common base number for grammitid genera. The spores of the Grammitidaceae are remarkably uniform, and those of *Melpomene* photographed (as *Grammitis*) by Tryon & Lugardon (1991) are similar to those of other grammitid genera.

The gametophytes of 25 species of Grammitidaceae from Jamaica, including four of *Melpomene* (*M. anfractuosa*, *M. firma*, *M. moniliformis*, and *M. pilosissima*), were described by Stokey & Atkinson (1958). An examination of their work does not reveal any differences between the gametophytes of *Melpomene* and those of other grammitids.

Melpomene is a genus of mid to high elevations, generally occurring from 1,000 to 4,000 m. In the New World, it ranges from Mexico to Panama, the

Antilles, and South America from Venezuela to Bolivia, Argentina, and southeastern Brazil. In the Old World it occurs in Africa, Madagascar, and Réunion (Fig. 2), but is apparently absent from Malesia, southeastern Asia, and the Pacific. The genus contains about 20 species that are badly in need of a monograph.

The relationships of *Melpomene* within the Grammitidaceae are not clear. The genus may be most closely related to the other hydathodous neotropical genera, particularly *Lellingeria* (which also has clathrate scales), or to the species groups that include *Grammitis taxifolia* (L.) Proctor and *G. subscabra* (Klotzsch) C. Morton, which belong to a yet unpublished genus *Terpsichore*, with over 50 New World species. There is no close affinity to *Xiphopteris* (sensu Copeland, 1956), which we regard as a mixture of *Cochlidium* and *Micropolypodium*.

A few species in the Pacific Basin resemble *Melpomene* in having hydathodes and clathrate or subclathrate, entire rhizome scales, e.g., *Ctenopteris lasiostipes* (Mett.) Brownlie, *C.* aff. *blechnoides* (Grev.) W. Wagner & Grether (both from New Caledonia), and *C. curtisii* (Baker) Copel. (Malesia). These species differ from *Melpomene* in one or usually more of the following characteristics: tangential walls of the rhizome scales slightly darkened (not clear and transparent as in *Melpomene*); scales lacking glandlike papillae at the tips, not cordate basally, sometimes curving inward at the tip (*C. curtisii*); branched hairs lacking on the petiole and rachis; clumped soral setae (*C. lasiostipes*); nonaromatic dried leaves. It seems likely that the resemblances in scales are due to convergent evolution and are not an indication of affinity.

New Combinations

Melpomene allosuroides (Rosenstock) A. R. Smith & R. C. Moran, comb. nov. Basionym: *Polypodium allosuroides* Rosenstock, Meded. Rijks-Herb. 19: 16. 1913. *Ctenopteris allosuroides* (Rosenstock) Copel., Philipp. J. Sci. 84: 396. 1955 (1956). *Grammitis allosuroides* (Rosenstock) Lellinger, Amer. Fern J. 74: 58. 1984. TYPE: Bolivia. Cochabamba?: Lagodos Valley, 4,000 m, *Herzog 2373* (holotype, S not seen; isotypes, UC, US not seen).

Distribution. Bolivia.

Melpomene anfractuosa (Kunze ex Klotzsch) A. R. Smith & R. C. Moran, comb. nov. Basionym: *Polypodium anfractuosum* Kunze ex Klotzsch, Linnaea 20: 375. 1847. *Ctenopteris anfractuosa* (Kunze ex Klotzsch) Copel., Philipp. J. Sci. 84: 431. 1955 (1956). *Grammitis anfractuosa* (Kunze ex Klotzsch) Proctor, Rhodora 63: 35. 1961. TYPE: Venezuela. Mérida: *Moritz 330*? (isotype, US).

Distribution. Southern Mexico to Guyana and Peru, Antilles.

Melpomene assurgens (Maxon) A. R. Smith & R. C. Moran, comb. nov. Basionym: *Polypodium assurgens* Maxon, Contr. Gray Herb. 165: 73. 1947. *Ctenopteris assurgens* (Maxon) Copel., Philipp. J. Sci. 84: 386. 1955 (1956). *Grammitis assurgens* (Maxon) C. Morton, Contr. U.S. Natl. Herb. 38: 116. 1967. TYPE: Ecuador. Pichincha: Quito–Santo Domingo road, *Haught 3226* (holotype, US not seen).

Distribution. Ecuador, Colombia, Peru.

Melpomene brevipes (C. Morton) A. R. Smith & R. C. Moran, comb. et stat. nov. Basionym: *Grammitis sodiroi* var. *brevipes* C. Morton, Phytologia 22: 79. 1971. TYPE: Ecuador. Tunguragua: Mt. Tunguragua, *Spruce 5279* (holotype, K not seen).

Distribution. Western Ecuador.

Melpomene deltata (Mickel & Beitel) A. R. Smith & R. C. Moran, comb. nov. Basionym: *Grammitis deltata* Mickel & Beitel, Mem. New York Bot. Gard. 46: 198. 1988. TYPE: Mexico. Oaxaca: Dtto. Mixe, NW slope of Cerro Zempoaltépetl, *Mickel 4637a* (holotype, NY).

Distribution. Southern Mexico, El Salvador.

Melpomene dissimulans (Maxon) A. R. Smith & R. C. Moran, comb. nov. Basionym: *Polypodium dissimulans* Maxon, Contr. U.S. Natl. Herb. 10: 502. 1908. *Ctenopteris dissimulans* (Maxon) Copel., Philipp. J. Sci. 84: 415. 1955 (1956). *Grammitis dissimulans* (Maxon) F. Seymour, Phytologia 31: 179. 1975. TYPE: Guatemala. Alta Verapaz: near Cobán, *von Türckheim* (*J. D. Smith 884*) (holotype, US not seen).

Distribution. Guatemala.

Melpomene erecta (C. Morton) A. R. Smith & R. C. Moran, comb. nov. Basionym: *Grammitis erecta* C. Morton, Phytologia 22: 72. 1971. TYPE: Ecuador. Tunguragua: Mt. Tungura-

gua, *Spruce 5279A* (holotype, K not seen; isotype, GH).

Distribution. Venezuela, Ecuador, Peru.

Melpomene firma (J. Smith) A. R. Smith & R. C. Moran, comb. nov. Basionym: *Polypodium firmum* Klotzsch, Linnaea 20: 378. 1947 (non Kaulf., 1827). *Ctenopteris firma* J. Smith, Hist. Fil. 184. 1875. *Grammitis firma* (J. Smith) C. Morton, Contr. U.S. Natl. Herb. 38: 110. 1967. TYPE: Guyana, *Schomburgk 1170* (lectotype, inferentially chosen by Looser, Revista Univ. (Santiago) 36(1): 75. 1951, B not seen; isolectotype, K).

Polypodium aromaticum Maxon, Proc. U.S. Natl. Mus. 27: 743. 1904. *Ctenopteris aromatica* (Maxon) Copel., Philipp. J. Sci. 84: 418. 1955 (1956). *Grammitis aromatica* (Maxon) Proctor, Brit. Fern Gaz. 9: 218. 1965. *Xiphopteris aromatica* (Maxon) Crabbe, Brit. Fern Gaz. 9: 318. 1967. TYPE: Jamaica. Blue Mt. Peak, *Underwood 1449* (holotype, NY not seen; fragment US).

Polypodium herzogii Rosenstock, Repert. Spec. Nov. Regni Veg. 6: 176. 1908. TYPE: Bolivia. Cochabamba: Incacorral, *Herzog 783* (holotype, S not seen; isotypes, UC, US not seen).

Distribution. Southern Mexico to Honduras, Costa Rica to Guyana and Bolivia, Jamaica.

Melpomene flabelliformis (Poiret) A. R. Smith & R. C. Moran, comb. nov. Basionym: *Polypodium flabelliforme* Poiret, Encycl. 5: 519. 1804. *Grammitis flabelliformis* (Poiret) C. Morton, Contr. U.S. Natl. Herb. 38: 57. 1967. *Xiphopteris flabelliformis* (Poiret) Schelpe, Bol. Soc. Brot., sér. 2, 41: 217. 1967. TYPE: Réunion, *Commerson s.n.* (P-JU 1098C).

Polypodium rigescens Bory ex Willd., Sp. Pl. ed. 4, 5: 183. 1810. *Ctenopteris rigescens* (Bory ex Willd.) J. Smith, Hist. Fil. 184. 1875. *Xiphopteris rigescens* (Bory ex Willd.) Alston, Bol. Soc. Brot., sér. 2, 30: 27. 1956. *Grammitis rigescens* (Bory ex Willd.) Lellinger, Proc. Biol. Soc. Wash. 89: 383. 1985. TYPE: Réunion, *Bory s.n.* (holotype, B-W 19668; isotype, P-JU 1098C).

Grammitis katasophistes Mickel & Beitel, Mem. New York Bot. Gard. 46: 200. 1988. TYPE: Mexico. Oaxaca: Dtto. Mixe, NW slope of Cerro Zempoaltépetl, *Mickel 4637b* (holotype, NY).

Distribution. Southern Mexico, Costa Rica to Venezuela and Peru, southern Brazil, Hispaniola, Africa, Madagascar, Réunion.

Melpomene leptostoma (Fée) A. R. Smith & R. C. Moran, comb. nov. Basionym: *Polypodium leptostomum* Fée, Mém. Foug. 7: 58. 1857. *Ctenopteris leptostoma* (Fée) Copel., Philipp. J. Sci. 84: 421. 1955 (1956). *Grammitis leptostoma* (Fée) F. Seymour, Phytologia 31: 179. 1975. TYPE: Mexico. Veracruz: near Orizaba, *Schaffner 210* (holotype, P not found).

Polypodium productum Maxon, Contr. U.S. Natl. Herb. 13: 11. 1909. TYPE: Guatemala. Alta Verapaz: near Cobán, *von Türckheim II.1347*, pro parte (holotype, US).

Distribution. Southern Mexico, Guatemala.

Melpomene melanosticta (Kunze) A. R. Smith & R. C. Moran, comb. nov. Basionym: *Polypodium melanostictum* Kunze, Linnaea 9: 44. 1834. *Ctenopteris melanosticta* (Kunze) Copel., Philipp. J. Sci. 84: 385. 1955 (1956). *Grammitis melanosticta* (Kunze) F. Seymour, Phytologia 31: 179. 1975. TYPE: Peru, *Poeppig s.n.* (holotype, LZ destroyed).

Polypodium calvum Maxon, J. Wash. Acad. Sci. 12: 440. 1922. *Ctenopteris calva* (Maxon) Copel., Philipp. J. Sci. 84: 386. 1955 (1956). TYPE: Cuba. Oriente: *León 11131* (holotype, US).

Distribution. Southern Mexico, Guatemala, Costa Rica, Venezuela to Bolivia, Brazil, Cuba, Hispaniola.

Melpomene moniliformis (Lagasca ex Sw.) A. R. Smith & R. C. Moran, comb. nov. Basionym: *Polypodium moniliforme* Lagasca ex Sw., Syn. Fil. 33. 1806. *Ctenopteris moniliformis* (Lagasca ex Sw.) J. Smith, Hist. Fil. 184. 1875. *Grammitis moniliformis* (Lagasca ex Sw.) Proctor, Brit. Fern Gaz. 9: 219. 1965. *Xiphopteris moniliformis* (Lagasca ex Sw.) Crabbe, Brit. Fern Gaz. 9: 319. 1967. TYPE: Peru, collector not stated [Ruíz & Pavón?] (S not seen).

Distribution. Mexico to Venezuela, Bolivia, and southern Brazil, Jamaica, Hispaniola.

Melpomene pennellii (Copel.) A. R. Smith & R. C. Moran, comb. nov. Basionym: *Ctenopteris pennellii* Copel., Philipp. J. Sci. 84: 397. 1955 (1956). *Grammitis pennellii* (Copel.) C. Morton, Phytologia 22: 82. 1971. TYPE: Colombia. Cauca: "San José," San Antonio, *Pennell & Killip 7379* (holotype, US).

Distribution. Western Colombia.

Melpomene peruviana (Desv.) A. R. Smith & R. C. Moran, comb. nov. Basionym: *Polypodium peruvianum* Desv., Mém. Soc. Linn. Par-

is 6: 231. 1827. *Ctenopteris peruviana* (Desv.) J. Smith, Hist. Fil. 184. 1875. *Grammitis peruviana* (Desv.) C. Morton, Contr. U.S. Natl. Herb. 38: 115. 1967. *Xiphopteris peruviana* (Desv.) Crabbe, Brit. Fern Gaz. 9: 319. 1967. TYPE: Peru. Collector not stated (holotype, P).

Polypodium peruvianum var. *subgibbosum* Rosenstock, Meded. Rijks-Herb. 19: 16. 1913. TYPE: Bolivia. Cochabamba?: Valle Lagados, *Herzog 2373a* (holotype, S not seen; isotype, UC).

Distribution. Ecuador to Bolivia, Argentina, and Brazil.

Melpomene pilosissima (M. Martens & Galeotti) A. R. Smith & R. C. Moran, comb. nov. Basionym: *Polypodium pilosissimum* M. Martens & Galeotti, Nouv. Mém. Acad. Roy. Sci. Bruxelles 15(5): 39, t. 9, fig. 2. 1842. *Ctenopteris pilosissima* (M. Martens & Galeotti) Copel., Philipp. J. Sci. 84: 390. 1955 (1956). *Grammitis pilosissima* (M. Martens & Galeotti) C. Morton, Contr. U.S. Natl. Herb. 38: 114. 1967. *Xiphopteris pilosissima* (M. Martens & Galeotti) Crabbe, Brit. Fern Gaz. 9: 319. 1967. TYPE: Mexico. Oaxaca: *Galeotti 6397* (lectotype, designated by Smith, Fl. Chiapas 2: 124. 1981, BR; isolectotype, K).

Polypodium acrodontium Fée, Crypt. Vasc. Brésil 2: 58, t. 99, fig. 2. 1872. TYPE: Brazil. *Glaziou 4409* (holotype, P or RB not seen).

Grammitis zempoaltepetlensis Mickel & Beitel, Mem. New York Bot. Gard. 46: 205. 1988. TYPE: Mexico. Oaxaca: Dtto. Mixe, NW slope of Cerro Zempoaltépetl, trail from Tacoche to Totontepec, *Mickel 4638* (holotype, NY).

Distribution. Mexico to Honduras, Costa Rica to Surinam, Peru and Brazil.

Melpomene pseudonutans (Christ & Rosenstock) A. R. Smith & R. C. Moran, comb. nov. Basionym: *Polypodium pseudonutans* Christ & Rosenstock, Repert. Spec. Nov. Regni Veg. 5: 15. 1908. *Ctenopteris pseudonutans* (Christ & Rosenstock) Copel., Philipp. J. Sci. 84: 389. 1955 (1956). *Grammitis pseudonutans* (Christ & Rosenstock) C. Morton, Contr. U.S. Natl. Herb. 38: 114. 1967. TYPE: Ecuador. Tunguragua: slopes of Mt. Tunguragua, *Rimbach s.n.* (holotype, S not seen; isotypes, UC, US not seen).

Distribution. Colombia, Ecuador, Peru.

Melpomene rosarum (Copel.) A. R. Smith & R. C. Moran, comb. nov. Basionym: *Ctenopteris rosarum* Copel., Philipp. J. Sci. 84: 387. 1955 (1956). *Grammitis rosarum* (Copel.) C. Morton, Contr. U.S. Natl. Herb. 38: 116. 1967. TYPE: Ecuador. Chimborazo: vicinity of Huigra, *Rose 22232* (holotype, US not seen).

Distribution. Colombia, Ecuador.

Melpomene sodiroi (Christ & Rosenstock) A. R. Smith & R. C. Moran, comb. nov. Basionym: *Polypodium sodiroi* Christ & Rosenstock, Repert. Spec. Nov. Regni Veg. 5: 14. 1908. *Grammitis sodiroi* (Christ & Rosenstock) C. Morton, Contr. U.S. Natl. Herb. 38: 114. 1967. *Xiphopteris sodiroi* (Christ & Rosenstock) Crabbe, Brit. Fern Gaz. 9: 319. 1967. TYPE: Ecuador. Tunguragua: base of Mt. Tunguragua, *Rimbach 24* (holotype, P? or S?; isotypes UC, US not seen).

Distribution. Western Colombia, western Ecuador.

Melpomene vernicosa (Copel.) A. R. Smith & R. C. Moran, comb. nov. Basionym: *Ctenopteris vernicosa* Copel., Philipp. J. Sci. 84: 452, t. 9. 1955 (1956). *Grammitis vernicosa* (Copel.) C. Morton, Contr. U.S. Natl. Herb. 38: 110. 1967. TYPE: Costa Rica. Cartago: Alto de Estrella, *Standley 39140* (lectotype, designated by Morton, Contr. U.S. Natl. Herb. 38: 110. 1967, US not seen).

Distribution. Costa Rica, Panama, Venezuela, Colombia, Ecuador.

Melpomene wolfii (Hieron.) A. R. Smith & R. C. Moran, comb. nov. Basionym: *Polypodium wolfii* Hieron., Hedwigia 48: 249. 1909. *Grammitis wolfii* (Hieron.) C. Morton, Contr. U.S. Natl. Herb. 38: 115. 1967. TYPE: Ecuador. Pichincha: near Mindo, at base of Mount Pichincha, *Stübel 745* (holotype, B not seen).

Distribution. Western Ecuador.

Melpomene xiphopteroides (Liebm.) A. R. Smith & R. C. Moran, comb. nov. Basionym: *Polypodium xiphopteroides* Liebm., Kongel. Danske Vidensk. Selsk. Skr., Naturvidensk. Afd. ser. 5, 1: 196. 1849. *Grammitis xiphopteroides* (Liebm.) A. R. Smith, Amer. Fern J. 70: 26. 1980. TYPE: Mexico. Veracruz: "Hac. de Mirador," *Liebmann* [Liebm. Pl. Mex. 2548, Fl. Mex. 189] (lectotype, designated by Smith, Fl. Chiapas 2: 125. 1981, C).

Ctenopteris megaloura Copel., Philipp. J. Sci. 84: 391. 1955 (1956). TYPE: Guatemala. Alta Verapaz: Cobán, *von Türckheim II. 1855* (holotype, US).

Polypodium rigens Maxon, Proc. U.S. Natl. Mus. 27: 741. 1904. *Ctenopteris rigens* (Maxon) Copel., Philipp. J. Sci. 84: 422. 1955 (1956). *Grammitis rigens* (Maxon) Proctor, Brit. Fern Gaz. 9: 219. 1965. TYPE: Jamaica. John Crow Peak, *Maxon 1346* (holotype, US).

Distribution. Southern Mexico, Guatemala, Honduras, Costa Rica, Panama, Greater Antilles, Venezuela, Colombia, Ecuador, Peru.

Incertae Sedis

The following names are not in current use, and we have not seen their types. Nevertheless, they apparently belong to *Melpomene* and have been inluded here for the benefit of future monographers. Most will probably prove to be synonyms of the above names.

Jamesonia adnata Kunze, Farrnkräuter 2: 80, t. 133, fig. 1. 1851. TYPE: Colombia. Tolima: Páramo de Tolima, *Linden 1006* (holotype, LZ destroyed; isotypes, B not seen, FI not seen).

Polypodium angustissimum Fée, Crypt. Vasc. Brésil 2: 55, t. 96, fig. 3. 1873. TYPE: Brazil: *Glaziou 5297* (P or RB, not seen).

Polypodium moniliforme var. *bogotense* Hieron., Hedwigia 48: 249. 1909. TYPE: Colombia. Cundinamarca: Bogotá region, *Stübel 431* pro parte (holotype, B not seen).

Polypodium moniliforme var. *culebriliense* Bosco, Nuovo Giorn. Bot. Ital. N.S., 45: 149. 1938. TYPE: Ecuador. Chimborazo?: Páramo de Culebrilla, *Crespi s.n.* (holotype, TO not seen).

Polypodium moniliforme var. *major* Liebm., Kongel. Danske Vidensk. Selsk. Skr., Naturvidensk. Afd. ser. 5, 1: 196. 1849. TYPE: Mexico. Veracruz: Pico de Orizaba, *Liebmann* [Liebm. Pl. Mex. 2533, Fl. Mex. 183] (lectotype, designated by Smith, Fl. Chiapas 2: 123. 1981, C).

Polypodium moniliforme var. *minus* Christ, Bull. Soc. Bot. Genève sér. 2, 1: 217. 1909. SYNTYPES: Costa Rica. Cartago: Crater of Volcán Irazú, *Pittier 179* (P not seen, isosyntype US not seen); Brazil. Rio de Janiero: *Ule 3785* (P not seen).

Polypodium pilosissimum var. *glabriusculum* Mett., Abh. Senckenberg. Naturf. Ges. 2: 42. 1857. SYNTYPES: Mexico: *Leibold 97* (B not seen). Venezuela. Mérida: *Moritz 216* (B not seen, US); Distrito Federal: *Funck & Schlim 965* (B not seen).

Polypodium pilosissimum var. *hirsutum* Mett., Abh. Senckenberg. Naturf. Ges. 2: 42. 1857. TYPE: Venezuela. *Funck & Schlim 1848* (holotype, B not seen).

Polypodium subcrenatum Hook., Ic. Pl. 8: pl. 719. 1848. TYPE: Ecuador. Pichincha: *Jameson 215* (holotype, K not seen).

Polypodium subdicarpon Fée, Crypt. Vasc. Brésil 2: 55, t. 96, fig. 4. 1874. TYPE: Brazil. *Glaziou 4410* (holotype, P or RB, not seen).

Acknowledgments. We thank David B. Lellinger and Barbara S. Parris for helpful reviews of the manuscript.

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Carex david-smithii[1] (Cyperaceae), a New Species from High Andean Peru

D. N. Smith†
Department of Botany, Iowa State University, Ames, Iowa 50011, U.S.A.

A. A. Reznicek
University of Michigan Herbarium, Ann Arbor, Michigan 48109, U.S.A.

ABSTRACT. *Carex david-smithii* is described as new from Bolivia. It is most closely related to the Argentinean and Chilean *C. catamarcensis*, but differs in its dark, almost black, pistillate scales and strongly outcurved perigynia tapered to the beak. *Carex catamarcensis* has stramineous to reddish purple scales and straight perigynia abruptly contracted into the beak.

This new species was discovered in the process of preparing treatments of the monocotyledonous families included in the flora of the Huascarán National Park and International Biosphere Reserve (Smith, 1988).

The park includes the bulk of the Cordillera Blanca in the central Peruvian Andes. It extends from 8°50′ to 10°00′S latitude, a distance of nearly 160 km, and has an area of 340,000 ha. Elevations range from 3,240 m to 6,770 m, at the summit of Nevado Huascarán Sur. The Cordillera Blanca is the highest tropical mountain range in the world. The geological structure of the park is complex. The northern half is a mixture of granitic and sedimentary rocks, and the southern half is sedimentary. The rocks of the sedimentary series are often metamorphosed. During several epochs of the Pleistocene, the Cordillera was extensively glaciated, and still has many glaciers and icefields. The nature of the local geology and the effects of glaciation have resulted in steep and dissected topography.

The climate of the park is a summer rainy type, dominated by air masses coming from the east. The annual precipitation is between 700 and 1,100 mm, as estimated from published data (ONERN, 1972) and unpublished weather records collected by ElectroPerú. The mean annual temperatures are 6°–7°C at 4,000 m. At that elevation and above, freezing temperatures can occur in all months, and average minimum temperatures are below 0°C from July to December. This general picture is modified somewhat by the many microclimates created by the complex topography and geology of the Cordillera Blanca.

The vegetation of the park is a complex mosaic, including dwarf woods, shrublands, grasslands, aquatic and semi-aquatic communities, and extremely high Andean types. Of these, grasslands are the most widespread. Each vegetation type includes several different plant communities.

Carex david-smithii Reznicek, sp. nov. TYPE: Peru. Ancash: Huari Prov., Huarascán National Park, upper terrace, Quebrada Pachachaca, a lateral valley of Quebrada Rurichinchay, 4,040–4,200 m, 13 June 1986, *Smith, Gonzales & Maldonado 12600* (holotype, USM; isotypes, CPUN, HUT, ISC, MO, Huascarán National Park herbarium, Ministry of Agriculture, Huaraz). Figure 1.

Plantae rhizomatibus brevirepentibus; culmi 50–130 cm alti; vaginae basales brunneae vel dilute purpurascentes, glabrae. Folia ca. 15–17, plerumque basalia; laminae (28–)40–100 cm longae, 6–16 mm latae; vaginae ca. 8–35 cm longae, glabrae; ligulae ca. 4–15(–40) mm longae. Inflorescentiae 18–32 cm longae, ramuli primarii duplo (raro triplo) ramosi; spicae ultimae androgynae sessiles, 4.5–8 mm longae, 5–7.5 mm latae; bracteae infimae laminis 29–60 cm longis, 5.5–10.5 mm latis, plerumque evaginatis. Perigynia 2.8–3.9 mm longa, 0.9–1.4 mm lata, patentia, valde extrorsus curvata, plano-convexa, atrata, glabra. Achenium ca. 1.5 mm longum, ca. 1 mm latum, juvenile. Styli marcescentes; stigmata 2 interdum 3. Antherae 3, 1.6–2.2 mm longae.

Plants forming extensive clones from stout, short-creeping rhizomes; roots pale brown, felted with stramineous root hairs when young; culms 50–130 cm tall, stiffly erect, trigonous, antrorsely scabrous-angled on upper portions, with glabrous, brown or faintly reddish purple tinged bladeless basal sheaths

[1]David Smith, formerly Assistant Curator at the Missouri Botanical Garden, died tragically in Bolivia Feb. 7, 1991, after this manuscript was essentially complete. I have taken the liberty of changing the name of the species to commemorate him. —*A. A. Reznicek.*

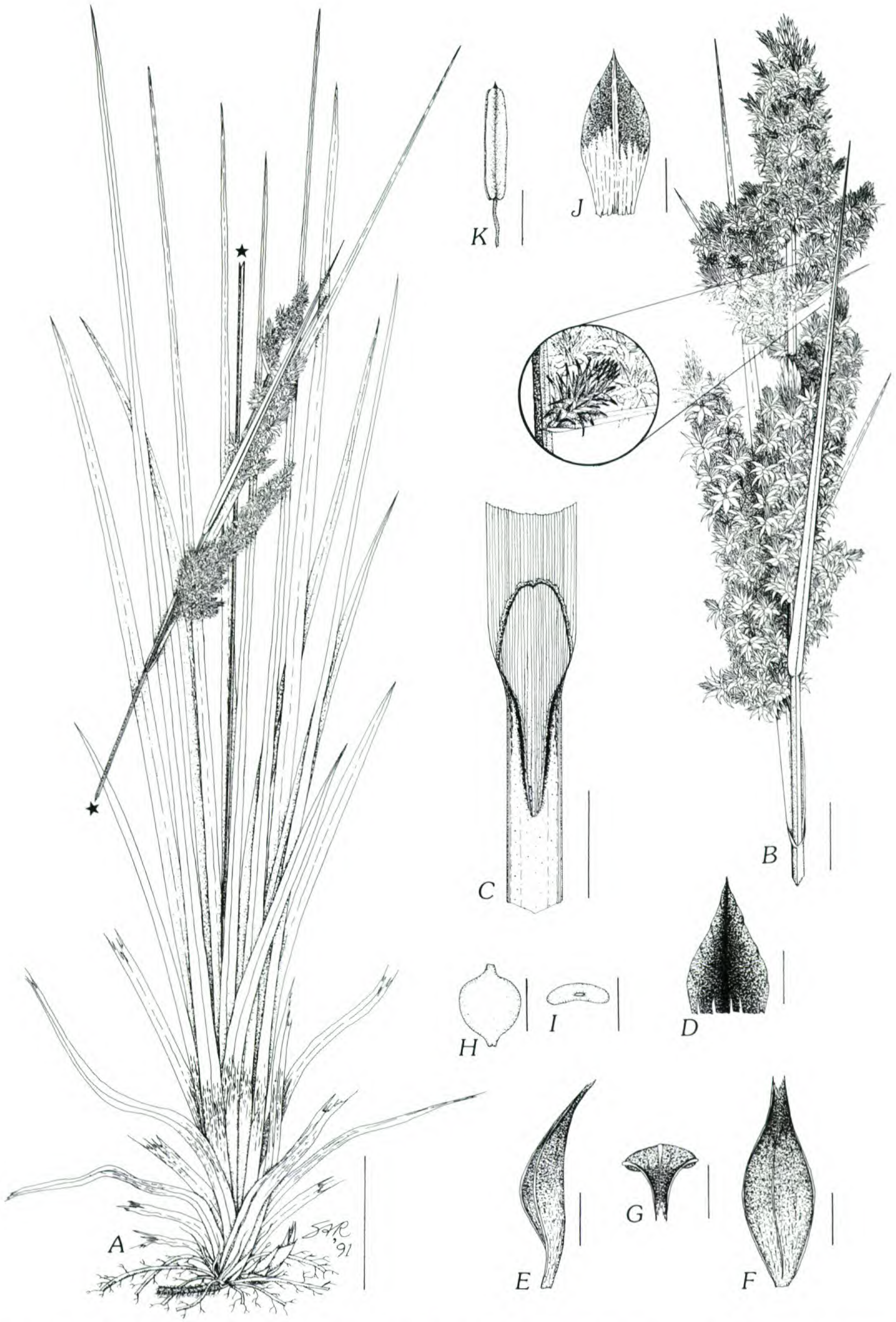

Figure 1. *Carex david-smithii*, drawn from *Smith et al. 12600* (ISC), isotype. —A. Habit. —B. Portion of inflorescence. —C. Sheath and ligule. —D. Pistillate scale. —E. Perigynium, side view. —F. Perigynium, front view. —G. Perigynium, top view. —H. Achene, front view. —I. Achene, top view. —J. Staminate scale. —K. anther. Bar equals 2 cm in A, 1 cm in B, C, and 1 mm in D–K.

with stramineous veins. Leaves ca. 15–17, mostly basal; blades (28–)40–100 cm long, 6–16 mm wide, plicate, papillose abaxially, glabrous adaxially, the margins and keel antrorsely scabrous, widest leaves 10–16 mm wide; leaf sheaths ca. 8–35 cm long, ± loosely enveloping culms, glabrous, the lower faintly purple tinged near base; inner band stramineous or red-streaked near margins, glabrous, faintly veined, the apex ± deeply concave, not or very slightly thickened, purple tinged; ligules ca. 4–15 (–40) mm long, obtuse to rounded at apex, the free portion stramineous to purple tinged. Vegetative shoots unknown. Inflorescences 18–32 cm long, upper inflorescence branches strongly overlapping, lowest two inflorescence branches 5.5–15.5 cm distant; single at nodes, erect to ascending on short, stiff, trigonous, ± scabrous-angled peduncles; the lowest inflorescence branches on peduncles 3–7.8 cm long, the upper sessile; lowermost bracts with blades 29–60 cm long and 5.5–10.5 mm wide, sheathless or rarely with a vestigial sheath up to 1.5 cm long, the uppermost bracts much reduced. Inflorescences highly compounded, with third- or rarely even fourth-order branching; primary inflorescence branches 6–8, the lowermost 9.5–21 cm long, ca. 1–2 cm wide, secondary branches ca. 18–40 per primary branch, the lowermost 0.9–2.4 cm long, ca. 0.8–1.2 cm wide, sessile or rarely with a peduncle up to 9 mm long. Ultimate branches short, androgynous, sessile spikes; spikes 4.5–8 mm long, 5–7.5 mm wide, ovate-orbicular with (1–)3–22 perigynia and ca. 4–8 staminate flowers; up to ca. 25 per secondary branch. Pistillate scales 2.1–2.8 mm long, 1.2–1.8 mm wide, ovate to broadly ovate, acute to acuminate or sometimes with a short awn up to 0.5 mm long, dark reddish purple to almost black with slightly paler margins, faintly 1–5-veined. Staminate scales 2.6–3.3 mm long, 1.2–1.6 mm wide, elliptic to narrowly obovate, acute to acuminate, dark reddish purple to almost black with paler margins, 1–3(–5)-veined. Perigynia 2.8–3.9 mm long, 0.9–1.4 mm wide, spreading and strongly outcurved, ± planoconvex with lanceolate to narrowly elliptic faces, dark reddish purple to almost black distally, lightening to stramineous below, heavily dotted with reddish tanniferous cells, glabrous, strongly 2-veined on the margins, veinless or more faintly 1–2-veined on the faces, tapering to a bidentate apex with teeth 0.3–0.4 mm long. Achenes ca. 1.5 mm long, ca. 1 mm wide, lenticular with broadly obovate faces. Styles withering, ca. 3 mm long, stigmas 2 or sometimes 3. Anthers 3, 1.6–2.2 mm long, yellow, dotted with reddish tanniferous cells.

Paratypes. PERU. ANCASH: Huari Prov., Huascarán National Park, 2 km below Cahuish Tunnel, 4,400 m, 30 Mar. 1985, *Smith & Escalona 10118* (CPUN, HUT, ISC, MO, USM, Huascarán National Park herbarium); slopes below and valley of Laguna Ichicpotrero, 4,100 m, 8 May 1986, *Smith et al. 12419* (CPUN, HUT, ISC, MICH, MO, USM, Huascarán National Park herbarium).

Most of the cited specimens of this handsome new species are immature, and even the holotype does not have completely fully developed achenes. Thus, measurements of achenes and, to some extent, perigyia are somewhat tentative pending further collections of mature material. Another new species, similar to *Carex ancashensis* but with even longer, acute ligules, red-dotted inner bands to the sheaths, apparently more ovate perigynia with shorter beaks showing no tendency to reflex, and a broader inflorescence with distant lower branches, is represented by a specimen from Quebrada Pucaraju, a lateral valley of Quebrada Rurichinchay, *Smith et al. 12698*, 15 June 1986 (MO, USM), but the specimen is unfortunately too immature to describe.

This species grows in habitats with saturated soils or in shallow standing or slowly flowing water including boggy or marshy areas, streamsides, or lake and pond shores. Specimens have been collected from 4,040 to 4,400 m in elevation. It has been found only in Huari Province, on the eastern side of the Cordillera Blanca, where it has been collected in the Pucavado (near the Cahuish Tunnel), Carhuazcancha (in Laguna Ichicpotrero), and Rurichinchay valleys. All the localities are within the Huascarán National Park. Flowering occurs in May and June and fruiting probably from June through August.

Carex david-smithii is most closely related to *C. catamarcensis* Kük. (including *C. latebracteolata* Kük.) of Argentina and Chile. Both are large plants with highly compounded inflorescences of very similar structure composed ultimately of small, sessile, androgynous spikes. Both have stigmas regularly both two and three in the same inflorescence, and perigynia heavily dotted with reddish tanniferous cells. *Carex david-smithii* differs in having very dark, almost black pistillate scales, staminate scales, and distal portions of perigynia. *Carex catamarcensis* has stramineous to reddish purple scales and perigynia. The perigynia of *C. david-smithii* are 2.8–3.9 mm long, tapered to the apex, and strongly outcurved distally, whereas those of *C. catamarcensis* are ca. 2.2–3.5 mm long, abruptly contracted into a short beak up to 0.6 mm long, and not outcurved.

Because of its highly compounded inflorescences, Kükenthal (1909) placed *Carex catamarcensis* in section *Fecundae* Kük. (subgenus *Carex*) close to *C. fecunda* Steudel, an arrangement also followed by Barros (1935). However, the uniform, small,

sessile, androgynous spikes and lack of cladoprophylls show that this species and *C. david-smithii* belong in subgenus *Vignea* (P. Beauv. ex Lestib. f.) Peterm. (Reznicek, 1990). As well, in *C. fecunda* and its allies, both the first and the larger second-order branches are on long, flexuous peduncles. In *C. david-smithii* and its allies, the first-order branches of the inflorescence have short, stiff peduncles and all the other branches are sessile or essentially so. The sectional affinities of these species within subgenus *Vignea* are as yet unclear and await a sectional revision of the subgenus.

Acknowledgments. Fieldwork resulting in this paper was supported by National Geographic Society Research Grant 3069-85. We thank Susan Reznicek for the figure.

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New Combinations in *Gnaphalium* (Asteraceae: Inuleae)

G. Ledyard Stebbins
Department of Genetics, University of California, Davis, California 95616, U.S.A.

David J. Keil
Biological Sciences Department, California Polytechnic State University, San Luis Obispo, California 93407, U.S.A.

ABSTRACT. Because of extensive morphological intermediacy, plants formerly distinguished at the species level as *Gnaphalium beneolens*, *G. microcephalum*, *G. thermale*, and *G. wrightii* are treated as intergrading races of the widespread *G. canescens*. The new combinations, *G. canescens* subsp. *beneolens*, *G. canescens* subsp. *microcephalum*, and *G. canescens* subsp. *thermale* are made.

In preparing the treatment of *Gnaphalium* L. for the forthcoming flora of California, *The Jepson Manual*, we have found that the species currently recognized as *G. beneolens* A. Davidson, *G. thermale* E. Nelson, *G. microcephalum* Nutt., and *G. wrightii* A. Gray intergrade to such a degree with respect to the characters used in current keys (Ferris, 1960; Munz, 1959, 1968, 1974) to differentiate them—decurrent versus nondecurrent leaf bases, nature of tomentum, character of capitulescence, size and shape of heads, and acute versus obtuse phyllary tips—that they cannot consistently be separated from each other. In addition, *G. wrightii* of easternmost California, Arizona, New Mexico, and northern Mexico is indistinguishable from *G. canescens* DC. of central Mexico. These entities are therefore all merged into a single polymorphic species, *G. canescens*. Recognizable geographic tendencies in variation are maintained as subspecies. The following new combinations are therefore proposed:

Gnaphalium canescens DC. subsp. **beneolens** (A. Davidson) Stebbins & Keil, comb. nov. *Gnaphalium beneolens* A. Davidson, Bull. So. Calif. Acad. Sci. 17: 17. 1918.

Gnaphalium canescens DC. subsp. **microcephalum** (Nutt.) Stebbins & Keil, comb. nov. *Gnaphalium microcephalum* Nutt., Trans. Amer. Phil. Soc. n.s., 7: 404. 1841.

Gnaphalium canescens DC. subsp. **thermale** (E. Nelson) Stebbins & Keil, comb. nov. *Gnaphalium thermale* E. Nelson, Bot. Gaz. (Crawfordsville) 30: 121. 1900.

Gnaphalium canescens subsp. *canescens* (including *G. wrightii*) occurs from the southwestern United States to central Mexico. In the desert mountains of eastern California it grades into subspecies *microcephalum*, a race chiefly of southern California. This in turn grades into subspecies *beneolens* in the South Coast Ranges of California. Plants of the Sierra Nevada foothills are mostly assignable to subspecies *beneolens*, but above 1,000 m, plants agree more with subspecies *thermale*. The latter ranges eastward to the Rocky Mountains and northward to British Columbia. Descriptions of these taxa and their ranges are included in our treatment of *Gnaphalium* in *The Jepson Manual*.

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Notes on the Rubiaceae of Peru

Charlotte M. Taylor
Missouri Botanical Garden, P.O. Box 299, St. Louis, Missouri 63166-0299, U.S.A.

ABSTRACT. *Raritebe axillare*, *Gonzalagunia mildredae*, and *G. villosa*, all of Peru and (except *G. mildredae*) Ecuador, are newly described; *Remijia megistocaula* is transferred to *Calycophyllum;* and a key is presented to the eight species of *Gonzalagunia* found in Peru.

These previously undescribed species and the need for the nomenclatural transfer were discovered during study of specimens recently collected in Peru.

NOTES ON *CALYCOPHYLLUM* DC.

Calycophyllum megistocaulum (K. Krause) C. M. Taylor, comb. nov. Basionym: *Remijia megistocaula* K. Krause, Bot. Jahrb. Syst. 40. 319. 1908. TYPE: Peru. Huánuco: between Monzón and Río Huallaga, *Weberbauer 3687* (holotype, B destroyed; photographs (F negs. #161, #162), MO).

Calycophyllum acreanum Ducke, Arq. Inst. Biol. Veg. 2: 709. 1935. TYPE: Brazil. Acre: Rio Acre, Seringal Iracema, 18 Mar. 1933, *Ducke HJBR-24414* (holotype, RB not seen; isotype, P not seen, photograph (F neg. # 37200), MO).

Examination of the type photographs shows that these names represent the same species. The leaves on the type collection of *Calycophyllum acreanum* appear discolored, but in other respects (size, shape, and venation pattern) they agree with the photograph of *Remijia megistocaula.*

This species was first described in *Remijia* DC., and was treated in that genus without comment by Standley (1936), who relied primarily on capsule dehiscence to distinguish *Remijia.* However, *R. megistocaula* differs from other *Remijia* species in its terminal inflorescences, rather than axillary, and its corollas with shortly funnelform tubes that are pilose internally and lobes that are convolute in aestivation, rather than elongated cylindrical tubes that are glabrous internally and valvate lobes. These unusual features of *R. megistocaula* are all characteristic of *Calycophyllum.* The capsules with septicidal dehiscence and valves that split secondarily from the apex, features that Standley used to characterize *Remijia*, are also characteristic of *Calycophyllum.* Other features used to characterize *Calycophyllum* are enlarged bracts that completely enclose developing cymules of flowers, and the presence of expanded petaloid calyx lobes that function as semaphylls (Steyermark, 1974). The enlarged bracts are found in several species of *Calycophyllum*, e.g., *C. candidissimum* (M. Vahl) DC., *C. multiflorum* Griseb., *C. spruceanum* (Benth.) Schum., but not in all, e.g., lacking in *C. obovatum* (Ducke) Ducke and *C. venezuelense* Steyerm. Similarly, the expanded calyx lobes are found in some species, e.g., *C. candidissimum*, *C. obovatum*, and *C. venezuelense*, but not all, e.g., lacking in *C. multiflorum* and *C. spruceanum.* The size, form, and texture of the corollas and capsules of *Remijia megistocaula* are generally similar to those of *Calycophyllum.* Thus the species seems best placed in this genus. Ducke commented in his description of *C. acreanum* that while he had no doubts about its generic placement, his new species was somewhat unusual morphologically within *Calycophyllum.*

NOTES ON *RARITEBE* WERNHAM

The characteristics of *Raritebe* were described in detail by Kirkbride (1979). These must now be emended to include axillary as well as terminal inflorescences. Kirkbride recognized only one variable species, *R. palicoureoides* Wernham, although this may be overly conservative in Central America (cf. Dwyer, 1980). The generic name is here treated as neuter, following Kirkbride (1979); usage by Dwyer (1980) has varied.

Raritebe axillare C. M. Taylor, sp. nov. TYPE: Ecuador. Esmeraldas: Río Zapallo Grande (tributary of Río Cayapa), trail from riverbank opposite to the evangelic mission station, 00°48′N, 78°52′W, 25 Oct. 1982, (imm. fl), *Barfod 41055* (holotype, MO; isotype, AAU not seen). Figure 1.

Haec species a congeneris omnibus inflorescentiis axillaribus differt.

Erect, small trees to 3 m tall, strigillose becoming glabrescent. *Leaves* opposite; blades elliptic, 16–28 cm long, 7–9.5 cm wide, at apex acute to slightly acuminate and often falcate, at base acute, char-

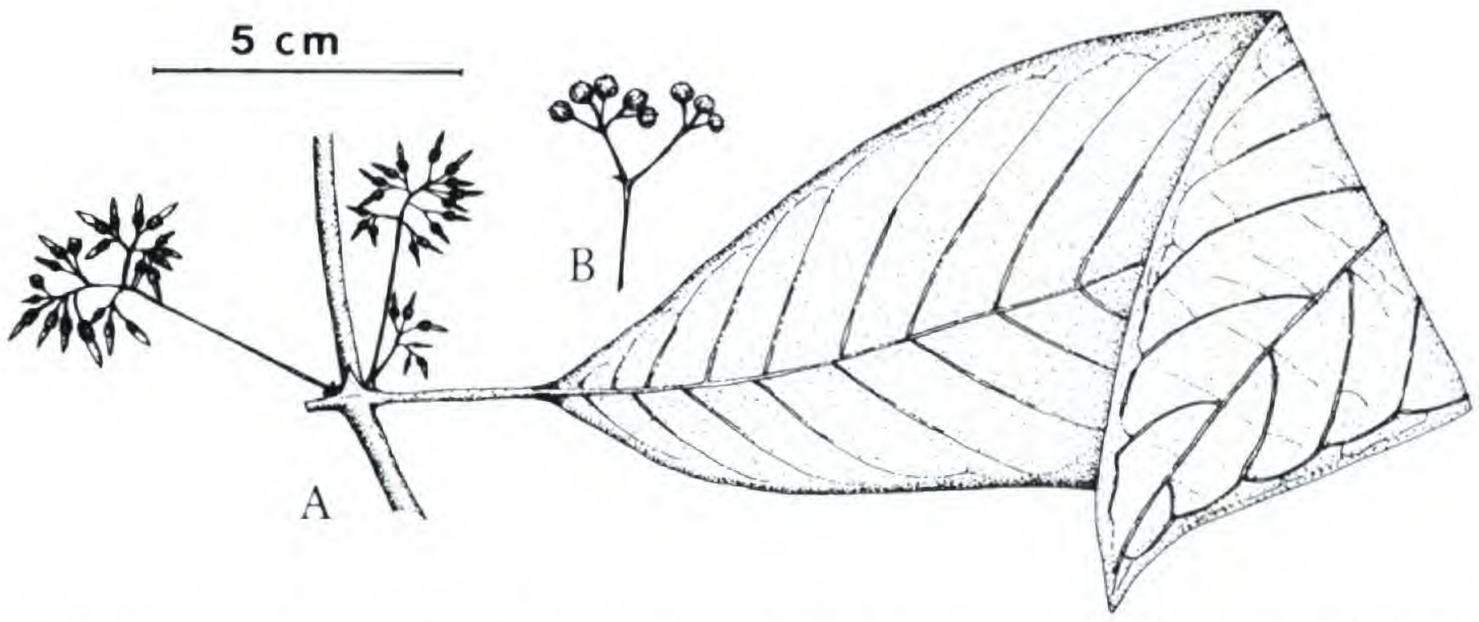

Figure 1. *Raritebe axillare* C. M. Taylor. —A. Habit. —B. Infructescence. Based on *Barfod 41055* (MO).

taceous, on both surfaces glabrous or usually sparsely to moderately strigillose along midrib and secondary veins; secondary veins 11–16 pairs, slightly to strongly interconnected to form an undulating submarginal vein, without domatia; petioles 1.5–4 cm long, similar to leaf midrib in pubescence; *stipules* persistent on distal 2–3 nodes, chartaceous, triangular, 3–10 mm long, acute. *Inflorescences* axillary, 1–2 per node, open cymose, with peduncles 1–5 cm long, with thyrses 2–10 cm long, 2–8 cm wide, with bracts triangular, to 1 mm long, with flowers ca. 15–30 in cymes of 2–5, with pedicels 2–5 mm long; branches, bracts, and pedicels green, strigillose or appressed-pilosulous. *Flowers* (immature) with hypanthium cupuliform to turbinate, strigillose, ca. 1–2 mm long; *calyx* limb 1–1.5 mm long, subtruncate to denticulate with 5 teeth; *corollas* salverform, white, externally puberulent to glabrous, lobes 5, narrowly triangular to linear. *Infructescences* similar to inflorescences; *fruit* subglobose, smooth, 3–4 mm long, 4–4.5 mm wide; *seeds* subglobose, ca. 0.1 mm diam., with reticulate testa.

Distribution. Coastal Ecuador and Amazonian Peru, in wet forest at 200–250 m elevation.

This species is placed in *Raritebe* based on its lack of raphides, paniculate-thyrsoid inflorescences with cymose branches, flowers with 5-lobed calyx and corollas, corollas with valvate, reduplicate aestivation and narrow acute shape in bud, baccate fruit, and numerous seeds with testa structure similar to that shown by García Kirkbride (1979: fig. 10) (Kirkbride, 1979). This new species is sympatric with and similar to *R. palicoureoides*, from which it differs in its axillary rather than terminal inflorescences. The specific epithet refers to this distinction.

Although several specimens of *Raritebe palicoureoides* show overtopping of old infructescences by vegetative growth from one axil, the plants described here clearly have axillary inflorescences, as demonstrated by production of inflorescences simultaneously from both axils of a node. These inflorescences are produced both with and proximal to healthy leaves, and originate from enlarged structures that suggest that the production of inflorescences in these axils is indeterminate. Variation is seen in development of a submarginal vein; similar variation in all leaf characters is seen in *R. palicoureoides*. The data accompanying the type collection indicate that the plant is used locally in the treatment of "headaches, fever, and body pains" by patting the body with the plant. Data accompanying the second collection indicate that the plant is not used medicinally in that area.

Paratypes. PERU. AMAZONAS: Río Cenepa, vicinity of Huampami, hill above Quebrada Tujushik, ca. 5 km E of Chávez Valdivia, 4°30'S, 78°30'W, 24 July 1978 (fr), *Ancuash 1081* (MO).

NOTES ON *GONZALAGUNIA* RUÍZ LOPEZ & PAVÓN

Gonzalagunia has not been treated comprehensively recently; its last review for Peru was by Standley (1936). The following key is offered as an outline of this genus in Peru and as a guide to the identification of the species newly described here.

KEY TO SPECIES OF *GONZALAGUNIA* IN PERU

1a. Leaf blades tomentose to floccose on lower surface of lamina, the trichomes generally white.
  2a. Leaf blades with sparse pubescence of lower surface of lamina spreading and dull white ..... *G. dependens* Ruíz Lopez & Pavón
  2b. Leaf blades with pubescence of lower surface of lamina appressed and bright white ..... *G. chionea* Standley ex Steyerm.
1b. Leaf blades glabrous to pilosulous on lower surface of lamina, the trichomes generally colorless to brown.

3a. Leaves subsessile, blades ovate, rounded to somewhat cordate at base ..... *G. mildredae* Simpson ex C. M. Taylor
3b. Leaves petiolate, blades elliptic to lanceolate, obtuse or cuneate to acute at base.
4a. Stems and lower leaf surfaces spreading-pilosulous, at least along midrib.
5a. Stipules with short base 1–2 mm long, abruptly contracted to a very narrowly triangular apex 2–10 mm long; corollas with tubes 5–6 mm long; fruit with 4 cocci ..... *G. villosa* Simpson ex C. M. Taylor
5b. Stipules triangular, uniformly tapered, 10–20 mm long; corollas with tubes 6.5–8 mm long; fruit with 2 cocci ..... *G. pachystachya* Standley
4b. Stems and lower leaf surfaces appressed-strigose to -strigillose.
6a. Corolla tubes 7–8 mm long, lobes 5–6 mm long; pedicels 1–4 mm long ..... *G. affinis* Standley ex Steyerm.
6b. Corolla tubes 4–6 mm long, lobes 2–3 mm long; pedicels to 1.5 mm long.
7a. Leaf blades 1.5–5.5 cm wide ..... *G. cornifolia* (HBK) Standley
7b. Leaf blades 6–15 cm wide ..... *G. bunchosioides* Standley

Gonzalagunia mildredae D. Simpson ex C. M. Taylor, sp. nov. TYPE: Peru. Huánuco: Prov. Leoncio Prado, distrito Rupa Rupa, road to Jacintillo, left bank of Río Monzón, 20 Mar. 1972 (fl), *Schunke 5293* (holotype, MO; isotype, F). Figure 2.

Gonzalaguniae sessilifoliae Standley similis, sed ab ea stipulis longioribus (15–20 mm longis), lobulis calycinis aequalibus ca. 0.8 mm longis et tubo corollino longiore (8–9 mm longo) differt.

Erect shrubs or small trees to 12 m tall, strigillose to usually strigose throughout. *Leaves* opposite, subsessile; blades ovate, 6–14 cm long, 2.5–6.5 cm wide, at apex long-acute to slightly acuminate, at base rounded to somewhat cordate, chartaceous to somewhat subcoriaceous, above glabrous to sparsely strigillose, below strigillose along the veins but glabrous on the remaining surfaces; secondary veins 8–10 pairs, basal 2–4 veins originating from petiole attachment, without domatia; petioles 0–2 mm long, similar to leaf midrib in pubescence; *stipules* persistent, membranaceous, strigillose to glabrescent, lanceolate to triangular, 15–20 mm long, acute to slightly acuminate, sometimes with a thickened midrib. *Inflorescences* spiciform, with peduncles 3–6 cm long, with thyrses 20–33 cm long, 1–2 cm wide, with bracts narrowly triangular to linear, 2–5 mm long, with flowers ca. 40–60 in sessile cymules of 1–3, these separated 3–10 mm along axis, with pedicels 1–3 mm long; axis, peduncle, bracts, and pedicels green, densely strigillose; *flowers* with hypanthium cupuliform, densely strigillose to pilosulous, 1–1.5 mm long; *calyx* limb glabrous, 0.8–1 mm long, lobed for ca. ½ its length, lobes 4, rounded, with sinuses rounded; *corollas* salverform, white, externally densely appressed-pilose to more sparsely so on lobes, internally pilosulous at apex of tube with trichomes included, tubes 8–9 mm long, lobes 4, lanceolate, 4–5 mm long, 3–4 mm wide, rounded; anthers very narrowly oblong, 2.1–2.2 mm long. *Infructescences* similar to inflorescences; *fruit* subglobose to oblate, with 4 cocci, 4–5 mm long, 5–6 mm wide when young, becoming white and 8 mm long, 9 mm wide.

Distribution. Amazonian Peru, in wet forests at 680–1,100 m elevation.

This species is distinguished by its subsessile ovate leaf blades with the basal 2–4 veins originating from the petiole attachment and the base rounded to usually subcordate. In this respect it is similar to *Gonzalagunia sessilifolia* Standley of Ecuador, which can be separated by its broader leaves, 5–9 cm wide, of a markedly more membranaceous texture; its shorter stipules, 5–10 mm long, that are narrowly triangular to subulate; its longer and markedly unequal calyx lobes, 1–3 mm long on a single flower; and its smaller corollas, with tubes 2.5–3 mm long and lobes 1–1.5 mm long.

Gonzalagunia mildredae was separated as a new species and its name chosen by Donald Simpson, formerly of the Field Museum of Natural History, who unfortunately did not publish his work. The name and the type specimen he selected are used here. The specific epithet honors Mildred Mathias, an outstanding student of the South American flora.

Paratypes. PERU. HUANUCO: Prov. Leoncio Prado, Tingo María, 3 Aug. 1964 (fr), *Dwyer 6283* (MO); distrito Rupa Rupa, road from Tingo María to Lechuzas Cave, 9°18′S, 75°59′W, 24 Mar. 1982 (fl), *King & Ramírez Rengifo 369* (MO); vicinity of Tingo María, trail from airport bridge to Monzón–Huallaga junction, 21 June 1960 (fl, fr), *Mathias & D. Taylor 4063* (F, MO). UCAYALI: Prov. Coronel Portillo, distrito Padre Abad, Río Chino W of Acapulco Restaurant, 6 June 1976 (fl, fr), *Schunke 9164* (F, MO).

Gonzalagunia villosa D. Simpson ex C. M. Taylor, sp. nov. TYPE: Peru. Ucayali: Prov. Coronel Portillo, distrito Callería, Carretera Pucallpa Km 90, San Alejandro, 21 Feb. 1972

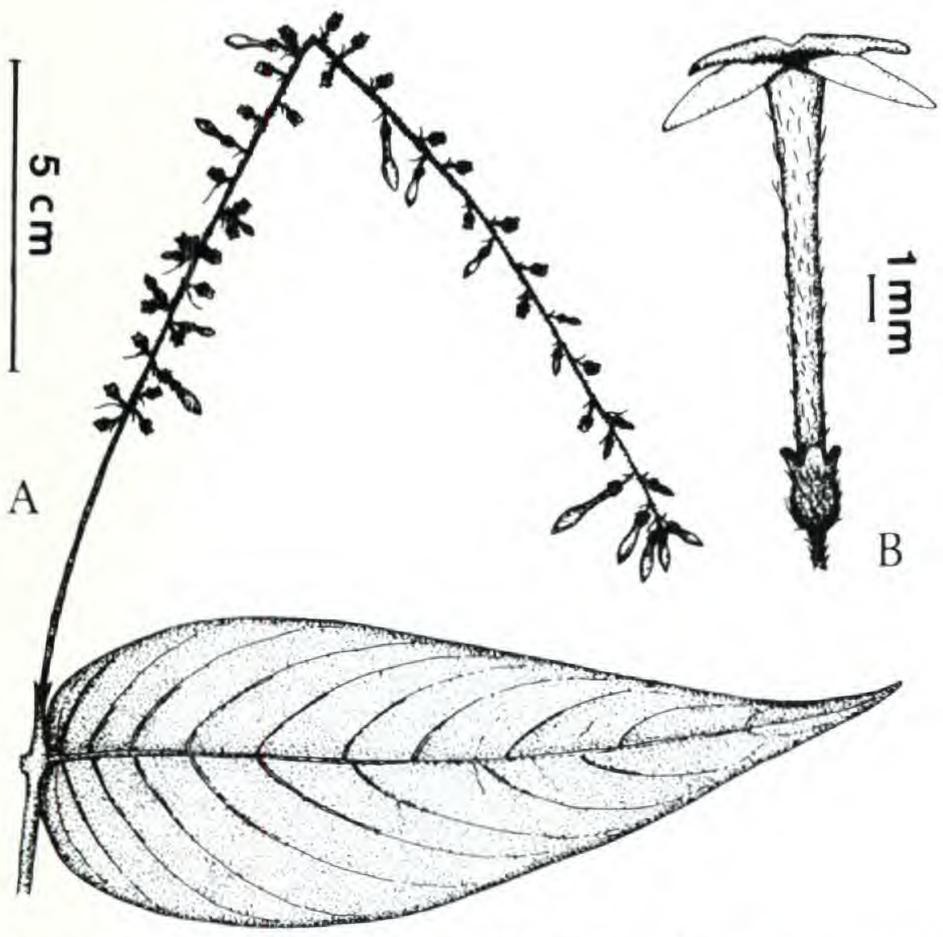

Figure 2. *Gonzalagunia mildredae* D. Simpson ex C. M. Taylor. —A. Habit. —B. Flower. Habit based on *King & Ramírez 369* (MO), flower on *Mathias & Taylor 4063* (MO).

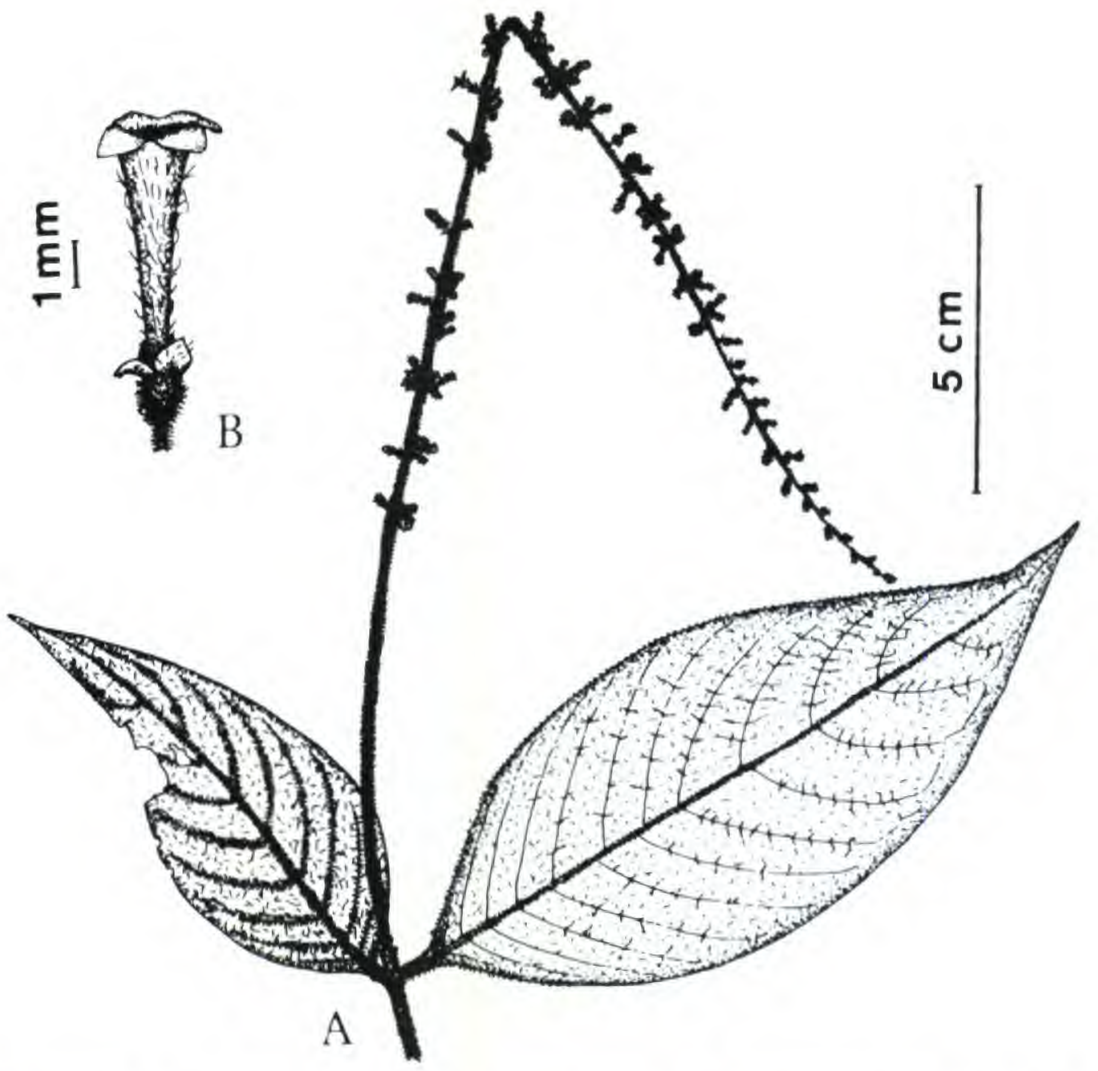

Figure 3. *Gonzalagunia villosa* D. Simpson ex C. M. Taylor. —A. Habit, smaller leaf showing abaxial surface. —B. Flower. Based on *Schunke 5272* (MO).

(fl, fr), *Schunke 5272* (holotype, MO; isotype, F). Figure 3.

Haec species a parte majore congenerorum indumento pilosulo dense etiam a *Gonzalagunia pachystachya* Standley corollae tubo 5–6 mm longo et lobulis 3–4 mm longis instructa differt.

Erect shrubs or small trees to 9 m tall, densely pilosulous throughout with trichomes spreading and usually drying brown. *Leaves* opposite or occasionally ternate; blades elliptic to lanceolate, 5–28 cm long, 2–11 cm wide, at apex acute to slightly acuminate, at base acute to cuneate, chartaceous to membranaceous, above glabrescent to sparsely appressed-pilosulous or sometimes more densely so on midrib, below spreading-pilosulous; secondary veins 7–13 pairs, without domatia, with midrib frequently pale or reddened below; petioles 2–20 mm long, similar to leaf midrib in pubescence; *stipules* persistent, chartaceous, pilosulous, triangular with basal portion 1–2 mm long and abruptly contracted to a narrowly triangular to linear tip 2–10 mm long. *Inflorescences* spiciform, with peduncles 1.5–3.5 cm long, with thyrses 15–30 cm long, 1–2 cm wide, with bracts linear, to 3 mm long, with flowers ca. 60–100 in sessile cymules of 2–5, these separated 3–10 mm along axis, with pedicels 0.5–2.5 mm long; axis, peduncle, bracts, and pedicels green, densely strigillose to pilosulous; *flowers* with hypanthium ellipsoid, densely strigillose to pilosulous, 1–1.5 mm long; *calyx* limb glabrous, 1–1.5 mm long, lobed nearly to base, lobes 4, ovate to elliptic, frequently unequal, rounded, with sinuses acute; *corollas* salverform, white, externally moderately to densely strigillose to often sparsely so on lobes, internally pilosulous at apex of tube with trichomes included, tube 5–6 mm long, lobes 4, triangular, 3–4 mm long, 1–1.2 mm wide, rounded to obtusely angled. *Infructescences* similar to inflorescences; *fruit* subglobose to oblate, with 4 cocci, 2–2.5 mm long, 3–4 mm wide, becoming white.

Distribution. Amazonian Ecuador and Peru, in wet forests at 200–450 m elevation.

Gonzalagunia villosa is distinguished by its dense pilosulous pubescence, relatively small stipules with narrowly triangular apices, and relatively short corollas. *Gonzalagunia pachystachya* Standley of Ecuador and Peru is similarly pilosulous, but differs in its triangular stipules that are not strongly narrowed at the apex, corollas with tubes 6.5–8 mm long and lobes 5–6 mm long, and fruit with 2 cocci and 3–4 mm long by 4–6 mm wide. The specific epithet refers to the characteristic pubescence.

The flowers of *Gonzalagunia villosa* are reportedly fragrant. This species shows wide variation in leaf size. The type specimen has leaves that generally represent the smaller end of the range. Similar variation in vegetative features is seen in many, if not most, species of *Gonzalagunia*, which characteristically are found in secondary habitats, although the labels of *G. villosa* generally attribute it to dense or mature forest.

Paratypes. ECUADOR. NAPO: Jatun Sacha Biological Station, 8 km E downstream of Puerto Misahualli, on the Río Napo, 1°04′S, 77°37′W, 28 Mar. 1990 (fl, fr), *Bensman 80* (MO); Coco, road to Las Arcas, spur trail to N, 23 July 1977 (fl), *Boeke 2221* (MO); along road SE of Francisco de Orellano (Coco) on the way to El Auca, 14.6

km past bridge over the Río Napo, 00°37′S, 76°40′W, 5 Oct. 1980 (fl), *Croat 50393* (MO). PERU. AMAZONAS: SE of Huampami, trail to Aintami, 17 Dec. 1972 (fl), *Berlin 587* (F, MO); ridge above Quebrada Chikishuk, a tributary of Huampami, entering from S about 5 km from confluence with Río Cenepa, 21 Dec. 1972 (fl), *Berlin 653* (F, MO); S of Huampami, trail to house of Theodora, S of Río Cenepa, 17 July 1974, *Berlin 1683* (F, MO); Huambisa, valle del Río Santiago, ca. 65 km al N de Pingo, Quebrada Caterpiza, 2–3 km atrás de la comunidad de Caterpiza, 19 Sep. 1979 (fr), *Huashikat 687* (MO), 11 Feb. 1980 (fl), *Huashikat 2039* (MO); Aintami, al lado del Río Cenepa, 14 Feb. 1973 (fl, fr), *Kayap 357* (F, MO); Huampami, Río Cenepa, 15 June 1973 (fl, fr), *Kayap 974* (F, MO); Quebrada Satik entsa, 16 July 1974 (fl, fr), *Kayap 1111* (F, MO); al lado del Río Huampami, 18 July 1974 (fr), *Kayap 1220* (F, MO); Río Cenepa, vicinity of Huampami, ca. 5 km E of Chávez Valdivia, 10 km en camino de Chigkan entsa, 4°30′S, 78°30′W, 8 Aug. 1978 (fr), *Kujikat 199* (MO); Río Cenepa, vicinity of Huampami, ca. 5 km E of Chávez Valdivia, al lado de Kachaim, Quebrada Huampami, 4°30′S, 78°30′W, 15 Aug. 1978 (fl), *Kujikat 391* (F, MO). SAN MARTIN: Prov. Lamas, distrito Lamas, N of San Antonio 2–4 km along Río Cumbasa, 2 Oct.–4 Nov. 1937 (fl, fr), *Belshaw 3529* (MO). UCAYALI: Padre Abad, Pucallpa, Irezola, Km 79 camino Francisco Basáche, 10 Apr. 1989 (fr), *F. Chávez 336* (MO).

Acknowledgments. I thank Lennart Andersson and anonymous reviewers for helpful comments, and Roy E. Gereau for preparation of the Latin diagnoses. I am particularly indebted to Amy Pool, who checked nomenclatural points, and Donald Simpson, who pointed the way in *Gonzalagunia*.

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A New Species of *Puya* (Bromeliaceae) from Central Peru

Walter Till
Institut für Botanik, Universität Wien, Rennweg 14, A-1030 Wien, Austria

ABSTRACT. *Puya lutheri* is described as a new species of Bromeliaceae: Pitcairnioideae. The diagnostic characteristics distinguishing it from *P. fosteriana*, the closest related species, are given.

While studying specimens of Bromeliaceae from ISC, I was unable to determine one of *Puya* with the available literature (e.g., Smith & Downs, 1974). The collector wrote "*Puya* aff. *clava-herculis*," while Harry Luther from SEL stated "*Puya* sp. nov., aff. *pygmaea* L. B. Sm. et *P. cryptantha* Cuatr." I agree with Luther that the present specimen respresents a new species, but disagree in its alliance.

After a critical check of many possibilities in the *Flora Neotropica* keys, and after comparison with the descriptions, respectively, I am convinced that the new species is allied to *P. fosteriana* L. B. Smith because of the overall similarity of both species (see also Foster, 1984). Using subkey IV of Smith & Downs's monograph (1974) and applying the given characteristics rigorously, the present specimen keys out as *P. trianae* Baker from Colombia. But if one assumes that the "outer bracts conspicuously serrate," is instead "entire or very obscurely serrate" in a closely related species, one reaches *P. fosteriana* L. B. Smith (1950). The serration of bracts is not a characteristic to infer natural alliances, but only a tool in an artificial key to separate taxa.

Puya lutheri W. Till, sp. nov. TYPE: Peru. Ancash: Yungay Province, Huascarán National Park, Quebrada Huaripampa between Quebrada Paria and Morococha, 77°33′W, 8°56′S, alt. 3,930–4,500 m, 13 Jan. 1985, *Smith, Sanchez & Vidaurre 9196* (holotype, ISC 376409; isotype, MO not seen). Figure 1.

A *P. fosteriana* L. B. Smith vaginis foliorum angustioribus, laminis foliorum angustioribus subtus adpresso lepidotis spinis brevioribus, scapo longiori, inflorescentia simplici minore angustioribusque albido-lanuginosa, sepalis minoribus et petalis angustioribus pallide coeruleis differt.

About 1 m tall (according to Smith); leaves to 50 cm long; sheaths broadly triangular ovate, ca. 5 cm long and 5 cm wide, pale stramineous and glabrous on both faces, the margins entire except for the short spinulose transition with the blades; blades narrowly triangular, 25–30 mm wide at the base, evenly tapering to a point, glabrous above, densely pale appressed-lepidote beneath, the margins laxly but coarsely antrorse-spinose, spines dark brown, strictly to slightly curved, 4–6 mm long; scape unknown but estimated from the complete height to be ca. 60 cm long, 15 mm diam. below the inflorescence; scape bracts unknown; inflorescence ca. 20 cm long, ca. 5 cm diam., dense, simple, whitish lanuginose; floral bracts covering the flowers except for the petals, their sheaths ovate, ca. 6 cm long and 3 cm wide, membranaceous, brownish when dry, densely white lanuginose, the margins entire, their blades long-acuminate, laxly short-spinose, and reflexed, glabrescent; sepals linear-lanceolate, broadly acute, ca. 27 mm long and 5 mm wide, rigidly membranaceous, adaxially glabrous, abaxially densely whitish lanuginose, free, the posterior ones slightly carinate; petals spathulate, ca. 45 mm long, unappendaged, their blades about 9 mm wide, pale blue (according to Smith). Anthers versatile, 5 mm long and 1 mm diam., dark brown when dry. Ovary conical, 10 mm long and 3 mm diam., style slender, 20 mm long, stigma lobes twisted.

Terrestrial in grassland with rare scattered shrubs or stands of *Polylepis* sp., "Queshque" bank of rivulet between two moraines.

Puya lutheri differs from *P. fosteriana* in its narrower leaf sheaths and blades (the blades in *P. lutheri* being appressed-lepidote beneath), the shorter leaf spines, the longer scape, the simple, smaller and narrower, whitish lanuginose inflorescence, the smaller sepals, and the narrower, pale blue petals. *Puya lutheri* and *P. fosteriana* both occur at high elevations (Foster, 1984). The populations of the species are separated by a distance of about 1,400 km. This fact should not be over-emphasized, as a similar disjunction is found in *Puya raimondii* Harms.

The species is dedicated to Harry E. Luther from the Bromeliad Identification Center at the Marie Selby Botanical Gardens, Sarasota, Florida, who first recognized it as a novelty.

Acknowledgments. I thank Marshall R. Crosby (MO) and two anonymous reviewers for critically reading the manuscript and offering valuable suggestions.

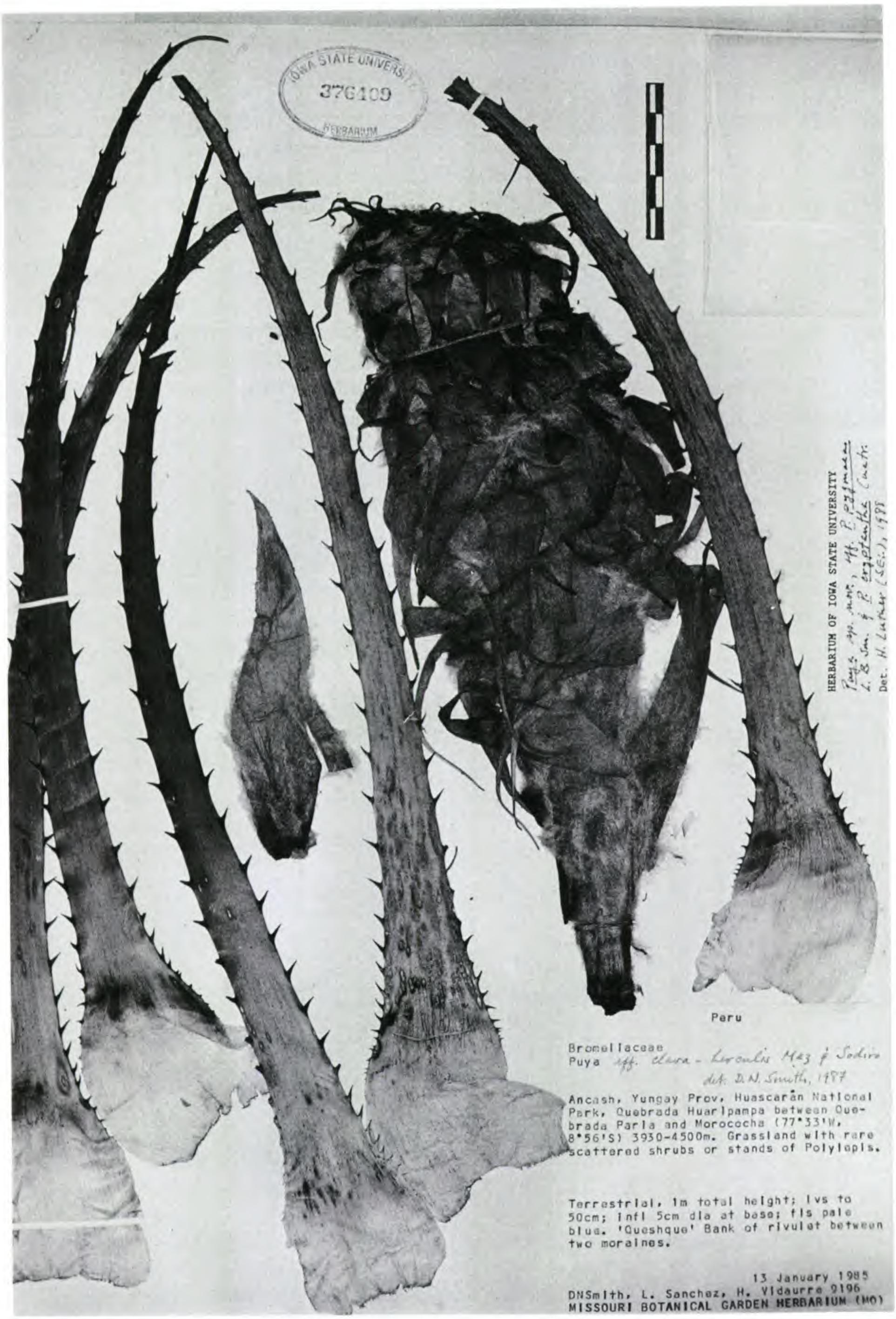

Figure 1. *Puya lutheri* W. Till, holotype (ISC 376409). Scale bar = 5 cm.

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Innovations in the Fern Genus *Phanerophlebia*

George Yatskievych
Missouri Botanical Garden, P.O. Box 299, St. Louis, Missouri 63166, U.S.A.

ABSTRACT. *Phanerophlebia gastonyi*, a new Mexican species, is described, and *P. remotispora* is reduced to varietal status under *P. nobilis*.

The genus *Phanerophlebia* (Dryopteridaceae) comprises eight species of terrestrial ferns of the New World tropics and adjacent subtropical regions. It was last revised taxonomically by Underwood (1899) and Maxon (1912), whose studies were based on the relatively few herbarium specimens in existence at that time. A recently completed doctoral dissertation (Yatskievych, 1990) involving biosystematic studies of this genus has not been fully published, and a taxonomic revision based upon this research is currently in preparation. Evidence from several independent experimental data sources can be correlated with the results of a morphological study of the wealth of recently collected specimens of *Phanerophlebia* to provide a clearer picture of species limits in the group.

The present note describes a new species and makes a new combination in *Phanerophlebia*. These names are needed for the forthcoming pteridophyte volume of *Flora Mesoamericana*.

Phanerophlebia gastonyi Yatskievych, sp. nov. TYPE: Mexico. Ca. 13 km NW of Berriózabal, limestone outcrops in evergreen tropical hardwood forest, elevation 1,000 m, 15 July 1985, *Yatskievych, González L., G. Ranker & C. Starr 85-182* (holotype, MO; isotypes, ARIZ, CHAPA, MEXU, IND, NY, UAMIZ, UC).

Species habitu *Phanerophlebiae juglandifoliae* (Humboldt et Bonpland ex Willdenow) J. Smith simillima, sed differt statura minora; pinnis 1–3(–4)-jugatis; paleis ad basem stipitis non imbricatis, bicoloribus, centro lato nigrescentibus, margine angusta pallidis; sporis 30–42 μm longis; chromosomatum numero $n = 41$.

Rhizomes to ca. 5 mm diam., short repent. Rhizome scales 2.5–4.5 mm long, 1.5–2 mm wide, ovate to elliptic-lanceolate, ciliate, bicolorous with broad, dark, sclerotic centers and narrow hyaline margins. Leaves to 45(–55) cm long, the petiole slightly shorter than to usually longer than lamina. Petiolar scales usually deciduous with age, mostly not overlapping, much like rhizome scales, the broadest 2 mm wide, the reduced hairlike scales uncommon among the broader scales. Pinnae 1–3(–4) pairs, to 12(–15.5) cm long, ovate to lanceovate, sometimes somewhat falcate, the apex acute to attenuate, the base obliquely cuneate to rounded, sometimes nearly equilateral, the margins entire to slightly undulate proximally, spinulose-serrulate only in distal half. Gemmiferous buds absent from axils of distal pinnae. Secondary veins with 1–3 series of regular marginal anastomoses, 2–4-branched. Sori in (1–)2–4 series between costa and margin, exindusiate. Spores monolete, 30–42 μm long. $n = 41$.

Illustration. Mickel & Beitel (1988, as *P. juglandifolia*).

Distribution. Moist soil, less commonly on fissured limestone rock faces, in cloud forests and montane rainforests; 900–2,200 m. Southern Mexico (Chiapas, Oaxaca, Veracruz).

This species is named for the eminent American pteridologist, Gerald J. Gastony, whose advice and assistance has nurtured my developing interest in ferns for many years. It is an infrequently collected taxon and is known from very few sites.

Specimens of *P. gastonyi* have previously been identified as *P. juglandifolia*. The latter species occurs from southern Mexico to northern Venezuela and Colombia. The two species are very similar morphologically, but can be differentiated by the characters in the following key:

1a. Petiolar scales not overlapping, 4–6 mm long, with broad, dark, sclerotic centers and narrow, hyaline margins; gemmiferous buds absent; spores 30–42 μm long . . *Phanerophlebia gastonyi*

1b. Petiolar scales usually overlapping, 6–11 mm long, with dark brown central stripes and lighter margins of about equal width; gemmiferous buds often present on rachis in axils of distal pinnae; spores 41–60 μm long . . . . . *Phanerophlebia juglandifolia*

Yatskievych & Gastony (1987) discussed morphological and allozymic evidence that *P. juglandifolia* is an allotetraploid with diploid *P. gastonyi* as one of its parental taxa. They speculated that the diploid *P. macrosora* (Baker) L. Underwood might be the other progenitor, but were unable to confirm this. Yatskievych et al. (1988) used restriction site analysis of the chloroplast genome to confirm that *P. gastonyi* is a maternal parent of *P. juglandifolia*,

but also were unable to verify the identity of the other parental taxon.

Paratypes. MEXICO. CHIAPAS: 13 km N of Berriózabal, 2 Nov. 1971, *Breedlove & Smith 21652* (DS, F, MICH, NY). OAXACA: trail from San Pedro Nolasco N to the Llano Verde, 5 Oct. 1969, *Mickel & Hellwig 3786B* (NY). VERACRUZ: ca. 12 km S of Misantla, 3 Jan. 1974, *Conant 726* (GH, MEXU).

Phanerophlebia nobilis (Schlechtendal & Chamisso) C. Presl var. **remotispora** (Fournier) Yatskievych, comb. et stat. nov. *Phanerophlebia remotispora* Fournier, Mexic. Pl. 1: 100, 1872. *Cyrtomium remotisporum* (Fournier) C. Morton, Amer. Fern J. 47: 54, 1957. TYPE: Mexico. Veracruz: Orizaba, Izhuatlancillo, Aug. 1865–1866, *Bourgeau 2349* (holotype, P; isotypes, BM, GH, K, MICH, MO, NY, P, US).

Previous authors (cf. Tryon & Tryon, 1982) uniformly have treated variety *remotispora* as a distinct species. These authors emphasized anastomosing versus free venation patterns as a critical character in subdivision of *Phanerophlebia* into two species groups. Yatskievych et al. (1988) showed that *P. nobilis* and *P. remotispora* are genetically very closely related, based on analysis of chloroplast-DNA restriction-site variation, and suggested that anastomosing veins were probably derived twice independently within the genus.

Variety *remotispora* differs from typical *P. nobilis* only in its venation pattern, with copious marginal anastomoses, rather than the free veins found in variety *nobilis*. The two varieties are sympatric in much of Mexico, although they are seldom encountered in mixed populations. Rare specimens of intermediate morphology (veins with few, irregular anastomoses) originate from Michoacán (*Arsène 5961*; GH, MO, US) and Veracruz (*Fisher s.n.*; MO), Mexico, and are apparently fully fertile.

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